The Journal of Experimental Education

A periodical report of scientific investigations relating to child development, curriculum, learning, teaching, supervision, measurements, statistics, and experimental techniques.

Volume XXII | September, 1953 | Number 1

CONTENTS

Page

Performance in a Verbal Addition Task Related to Pre-Experimental 'Set' and Verbal Noise — *E. Victor Mech* 1

Intergroup Attitudes and Experimental Change — *Margaret L. Hayes and Mary Elizabeth Conklin* 19

The Relationship Between the Social Structure of the Classroom and the Academic Success of the Pupils — *Margaret M. Buswell* 37

Relations Among Factors of Raw, Deviation, and Double-Centered Score Matrices — *Chester W. Harris* 53

Factors Related to the Extent of Mortality Among Home Economics Students in Certain Colleges of Minnesota, Wisconsin, and Iowa During 1943–50 — *Helen Y. Nelson* 59

$5.00 A YEAR | **PUBLISHED QUARTERLY** | **$1.50 A COPY**

Published by Dembar Publications, Inc., Madison 3, Wisconsin.
Entered as second-class matter October 17, 1938 at the post office at Madison, Wisconsin, under the act of March 3, 1879.

EDITORIAL BOARD

A. S. Barr, Chairman, Professor of Education, University of Wisconsin, Madison 6, Wis.

Arthur T. Jersild, Professor of Education, Teachers College, Columbia University, New York City. Editorially responsible for materials on child welfare, guidance, and development, published each December.

Palmer O. Johnson, Professor of Education, University of Minnesota, Minneapolis, Minnesota. Editorially responsible for materials on measurements, statistics, and methods of experimental research, published each March.

H. H. Remmers, Professor of Educational Psychology, Director Division Educational Reference, Purdue University, Lafayette, Indiana. Editorially responsible for materials on learning, teaching and supervision, published each September.

J. Wayne Wrightstone, Director, Bureau of Educational Research, Board of Education of the City of New York, Brooklyn, New York, 110 Livingston Street, Brooklyn, New York. Editorially responsible for materials on curriculum construction, published each June.

CONTRIBUTING EDITORS

Emmett A. Betts, Professor of Psychology and Director of Reading Clinic, Temple University, Philadelphia 22, Pennsylvania.

Gilbert L. Betts, Supervisor of Graduate Research in Education, Colorado State College, Fort Collins, Colorado.

Leo J. Brueckner, Professor of Education, University of Minnesota, Minneapolis, Minnesota.

Oscar K. Buros, Associate Professor of Education, Rutgers University, New Brunswick, New Jersey.

Guy T. Buswell, Professor of Educational Psychology, University of Chicago, Chicago, Illinois.

Harold D. Carter, Associate Professor of Education, University of California, Berkeley 4, California.

Leslie L. Chisholm, Associate Professor of Education, State College of Washington, Pullman, Washington.

Herbert S. Conrad, Technical Consultant, College Entrance Examination Board, Princeton, New Jersey.

Stephen M. Corey, Professor of Educational Psychology, University of Chicago, Chicago, Illinois.

Edward E. Cureton, 863 East Brewster Road, Alcoa, Tennessee.

Robert A. Davis, Professor of Education, Director of Bureau of Educational Research, University of Colorado, Boulder, Colorado.

Hari R. Douglass, Director of College of Education, University of Colorado, Boulder, Colorado.

Harold A. Edgerton, Director, Occupational Opportunities Service, Professor of Psychology, Ohio State University, Columbus 10, Ohio.

John C. Flanagan, Professor of Psychology, University of Pittsburgh, Pennsylvania.

Carter V. Good, Dean, Teachers College, University of Cincinnati, Cincinnati 21, Ohio.

Robert W. B. Jackson, Assistant Professor of Educational Research; Assistant Director, Department of Educational Research, Ontario College of Education, University of Toronto, Toronto, Canada.

Harold E. Jones, Professor of Psychology and Director, Institute of Child Welfare, University of California, Berkeley 4, California.

Neel Keys, Professor of Education and Lecturer in Human Relations, University of California, Berkeley, California.

D. Welty Lefever, Professor of Education, University of Southern California, Los Angeles, California.

Edward A. Lincoln, Consulting Psychologist, Halifax, Massachusetts.

Irving Lorge, Professor of Education, Executive Officer, Institute of Psychological Research, Teachers College, Columbia University, New York 27, New York.

A. R. Mead, Director of Educational Research, University of Florida, 330 P. K. Yonge Building, Gainesville, Florida.

T. E. Newland, Lt. Comdr., USNR, 2703 Wisconsin Avenue, N. W., Washington 7, D. C.

C. W. Odell, Professor of Education, University of Illinois, Urbana, Illinois.

Willard C. Olson, Professor of Education, Director of Research in Child Development, University of Michigan, Ann Arbor, Michigan.

Valworth R. Plumb, Chairman, Division of Education and Psychology, University of Minnesota (Branch), Duluth, Minnesota.

S. L. Pressey, Professor of Educational Psychology, Ohio State University, Columbus, Ohio.

Clarence E. Ragsdale, Professor of Education, University of Wisconsin, Madison, Wisconsin.

William Reitz, Associate Professor of Education, College of Education Examiner, Wayne University, Detroit 2, Michigan.

Henry D. Rinsland, Professor of Education and Director of Educational Research, The University of Oklahoma, Norman, Oklahoma.

Robert T. Rock, Jr., Professor of Psychology, Head of Dept. of Psychology, Graduate School, Fordham University, New York City.

Philip J. Rulon, Professor of Education, Harvard Graduate School of Education, Cambridge 38, Massachusetts.

Douglas E. Scates, Professor of Education, Duke University, Durham, North Carolina.

John Schmid, Board of Examiners, Michigan State College, East Lansing, Michigan.

Harold Seashore, Director, Test Division, The Psychological Corporation, New York 18, New York.

David Segel, Educational Consultant, Specialist in Tests and Measurements, Federal Security Agency, U. S. Office of Education, Washington, D. C.

Paul W. Terry, Professor of Educational Psychology, University of Alabama, University, Alabama.

Helen Thompson, Associate Attending Psychologist, New York Post-Graduate Hospital, 303 East 20th Street, New York 3, N. Y.

Robert L. Thorndike, Associate Professor of Education, Teachers College, Columbus University, New York City.

Herbert A. Toops, Professor of Psychology, Ohio State University, Columbus, Ohio.

Maurice E. Troyer, Director, Bureau of School Services, Syracuse University, Syracuse 10, New York.

Helen M. Walker, Professor of Education, Teachers College, Columbia University, New York City.

Beth L. Wellman, Professor of Psychology, Child Welfare Research Station, State University of Iowa, Iowa City, Iowa.

Guy M. Wilson, Emeritus Professor of Education, Boston University, 33 Pine Street, Wellesley Hills, Massachusetts.

Paul A. Witty, Professor of Education, Director of Psycho-Educational Clinic, School of Education, Northwestern University, Evanston, Illinois.

Ernest R. Wood, Professor of Education, New York University, New York City.

D. A. Worcester, Chairman Department of Educational Psychology and Measurement, University of Nebraska, Lincoln, Nebraska.

DEMOCRAT PRINTING COMPANY
MADISON, WISCONSIN

Journal of Experimental Education

Volume XXII September, 1953 Number 1

PERFORMANCE IN A VERBAL ADDITION TASK RELATED TO PRE-EXPERIMENTAL 'SET' AND VERBAL NOISE*

E. VICTOR MECH **
Indiana University

Introduction

THE EMPHASIS which is given to noise abatement campaigns implies a common assumption that noise is a hindrance to effective work. This interest in controlling noise has, however, far outrun the empirical evidence available. In view of this widespread interest, we might reasonably expect to find a considerable body of well grounded scientific literature relevant to the topic of noise and how it affects the behavior of man. Unfortunately, there is a lack of evidence dealing with the problem at the human level in terms which provide a basis for generalization.

Scope of the Investigation

The investigation was concerned with testing the hypothesis that a set of formal instructions concerning the subject matter of the experiment will influence the results obtained, when these results are defined as the performance of an individual in a specific task. The problem can be stated more precisely in the following manner.

Can it be demonstrated experimentally that systematic performance changes are possible in the presence of noise and quiet conditions, depending upon whether the subject expected the noise to be an aid or hindrance to subsequent performance? In its broader aspects the specific problem bears a relationship to experiments in which human subjects were used who were capable of imposing self instructions or to respond to minimal cues. This would include those experiments purporting to demonstrate that one educational method is better than another, or that one method of school learning is more efficient than another.

Design

Four groups of subjects were used, with 15 subjects assigned to each group. A total of 60 S's being used in the experiment. Each group worked eight days working under 2 conditions each day, one a noise condition, the other a quiet condition. Each condition on each day consisted of fifteen 60-second work periods. Thus each individual subject served a total of four work hours in the experiment, over the eight day period.

The experimental conditions for the four groups were as follows:

Group A. —The S's in this group were told only that the experiment concerned the effects of noise on work. They were told nothing in relation to whether noise should facilitate or inhibit their performance. S's were not informed of their daily progress under noise and quiet conditions.

* 'Set' is employed here to relate the formal instructions given S and performance as a consequence of these instructions.

**This paper is adapted from a thesis presented to the School of Education, Indiana University, in partial fulfillment of the Ph.D. degree. I am indebted to Dr. William H. Fox, whose encouragement and support were of inestimable value in the execution of the thesis investigation; to Dr. Arthur Coladarci of Stanford University, whose incisive comments and criticism aided materially in clarifying certain formal aspects of the analysis; to Dr. R. C. Davis and Dr. Delton Beir, Psychology Department, Indiana University, who contributed in no small measure to my thinking on this problem, and finally to Dr. Nicholas Fattu, Director, Institute of Educational Research, Indiana University, for acting in an advisory capacity with respect to the quantitative analysis.

Group B. —S's in this group were told that the experiment concerned the effects of noise on work. They were shown a faked work curve graph, which was presented to them as genuine, and that the results were from a previous experiment in this area. These faked curves indicated that in a previous experiment other S's had performed Better under the Noise conditions, than under the quiet conditions. The noise work curve (blue) was always above the quiet curve (red), each curve demonstrating the negative acceleration which is characteristic of some learning curves. As in Group A, the subjects in Group B were not informed of their daily results. Inquiries of this sort by individual S's were met with ambiguous replies.

Group C. —These S's were treated the same as those in Group B, except that the faked work curves demonstrated that previous S's had performed Better under the Quiet conditions. As in Groups A and B, the S's in this group were not informed of their daily progress or of "How they were doing."

Group D. —The S's in this group were treated the same as those in Group C, except that the faked work curves demonstrated that previous S's had at first performed Better under Quiet conditions for the first three or four days and then gradually getting accustomed to the noise, performed Better under the Noise conditions for the last three or four days. As with the other three groups, S's in Group D were not informed of their daily progress, i. e., whether or not they were getting different results under the varying conditions.

Procedure

As was specified in the design, the S's were shown faked work curves appropriate to the group to which they were randomly assigned. This is not to imply that by merely looking at the graphs, that the S's would be influenced by them. As a precautionary measure an attempt was made to standardize the presentation of the stimuli.

The following procedure was used: A set of formal instructions was presented to the subject upon entrance into the experimental room. Each S was instructed to read these aloud; then to study the graph, and then to give in his or her own words a short interpretation of what had been read, and of the work curves on the graph. The task instructions were presented to all S's on the Day 1 trial, in order to obtain an initial performance measure; the different experimental instructions were not presented until prior to the Day 2 trials.

The instructions were actually nothing more than a verbal description of what each set of graphs demonstrated. In this way, each S had at least verbalized what was contained in the written instructions, and on the graph. In this manner the experimenter was able to reinforce the formal material, with a comment—that the subject was expected to perform in a certain manner because previous subjects had performed in that way. Each subject was also told that at the end of each 30 minute session he would be asked whether he had performed better under the noise or the quiet condition. The appropriate spurious graph was kept on a desk in front of each S during the seven sessions served under experimental conditions; this refers to Groups B, C, and D, as Group A was not oriented by the experimenter in either direction. There was a 72 hour interval between the fifth and sixth replications, otherwise there was a 24 hour interval between the other replications.

It is pertinent to point out again, that the experimental conditions, as measured by a variable that we shall call Y, were not introduced until immediately prior to the second session. Prior to obtaining the measures of Y under experimental conditions, each S was given a preliminary 30 minute session, under both noise and quiet conditions, i. e., 15 minutes allotted to each condition. These preliminary measures we shall call X.

Broadly stated, the hypothesis that we wish to test is that there are no differences in the effects of the different sets of instructions, and that any differences in final mean scores of the experimental groups, after allowances have been made for chance differences in initial mean scores, are due primarily to chance fluctuations in sampling procedures. The allowances for initial differences were made in terms of the regression of final on initial measures. These operations were included in the analysis of covariance which was the primary statistical technique utilized in the analysis of the data.

Experimental Task and Noise Conditions

The task consisted of adding 6, 7, 8, and 9 successively to a given two-place number, and then repeating this operation for 60 seconds.

The addition would then be stopped by the experimenter, and S given another two-place number. Each of these 60 seconds of addition will be called a 'problem.' Each S was told to add as rapidly and accurately as possible; and, that he would be given credit for the total number of correct additions. Each S was allowed as many practice trials as needed to assure the experimenter that the task was understood. The number of correct responses during each 60 second period will be designated as the basic response measure. Clearly then, there were 15 such measures under noise and 15 measures under quiet for each S, each day. For the 15 minute session under noise each day, the sum of the responses in each one minute period was obtained and totaled, and the same procedure was used for the same S under

TABLE I

THE COMPOSITE PERFORMANCE SCORES OF FOUR GROUPS OF SUBJECTS UNDER NOISE AND QUIET CONDITIONS FOR EIGHT SESSIONS

		Day							
Group	Condition	1	2	3	4	5	6	7	8
A	Quiet	2581	3001	3539	3959	4189	4635	4697	4209
	Noise	2294	3029	3364	4050	4092	4504	4529	4160
B	Quiet	2806	2700	2988	3451	3302	3830	3643	4207
	Noise	2590	3743	3664	4301	4587	5257	4876	6372
C	Quiet	2371	3348	3961	4123	5287	4643	5156	4968
	Noise	2976	2702	3156	3300	3844	3782	4076	3934
D	Quiet	2612	3122	3312	3681	3197	4140	4083	4208
	Noise	2514	2425	2730	3337	3682	4965	4602	5304

TABLE II

COVARIANCE F VALUES UNDER NOISE FOR THE FOUR GROUPS OF S's

Days	1 - 2	1 - 5	1 - 6	1 - 8
F	7.87*	3.81*	1.26	9.96*

TABLE III

COVARIANCE F VALUES UNDER QUIET FOR THE FOUR GROUPS OF S's

Days	1 - 2	1 - 5	1 - 6	1 - 8
F	2.68	6.47*	4.30*	1.13

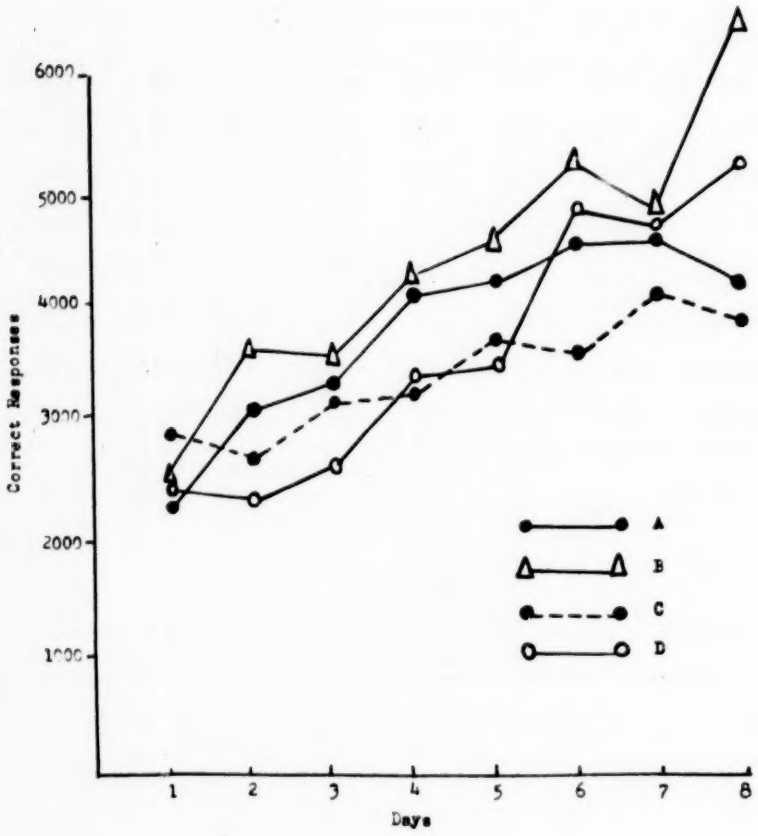


Figure 1. Performance Curves of 4 Groups of S's under NOISE for an 8 Day Period

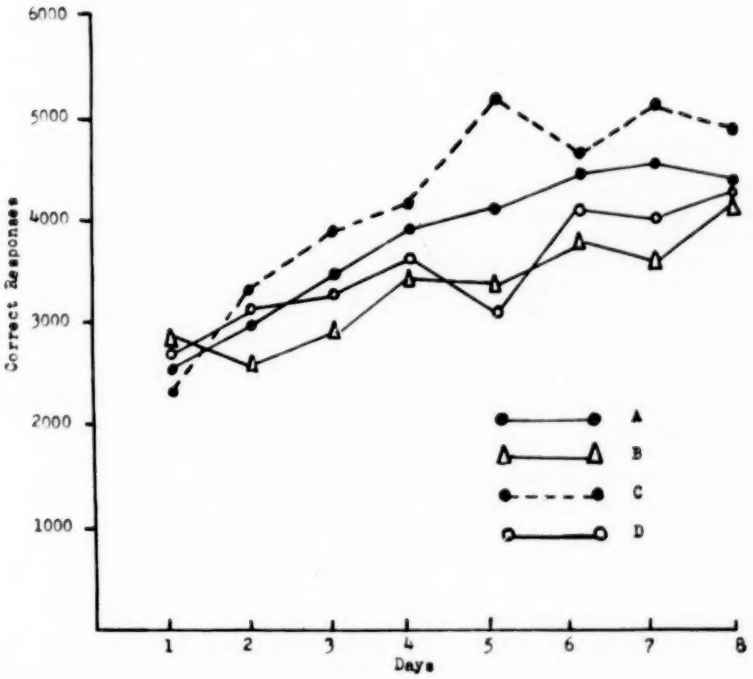


Figure 2. Performance Curves of 4 Groups of S's under QUIET for an 8 Day Period

quiet. Thus each S had two performance scores for each day.

Operationally Defined Noise Conditions

The verbal noise used in the experiment was Volume 1: "I Can Hear It Now," side number one. This record contains verbal narrations of important news events between the 1933-1945 era. The recording was played at an average intensity of 70 decibels, as measured by a sound level meter, model 759-B. The weighting characteristic used was flat. The measurement of 70 db. was made at the position the subject was sitting. The experimental room was not soundproof, and extraneous stimuli, which were difficult to control, were present on various occasions.

Selection and Random Arrangement of Subjects

The 60 subjects used in the experiment were from an undergraduate section in Educational Psychology. Participation in the experiment was a required class assignment. This probably helped eliminate any additional biasing to the sample, as found in the customary procedure of using volunteers. Each subject chose the session which was most appropriate to his particular schedule; this was of paramount importance because the experimental conditions required attendance the same time each day for eight sessions.

The systematic variation of the experimental instructions was made according to the schema on this page, in which A, B, C, and D represent the different "treatments."

SCHEMA: SYSTEMATIC VARIATION OF INSTRUCTIONS

Set I	Set II	Set III	Set IV
A	B	C	D
B	D	A	C
C	A	D	B
D	C	B	A
A	B	C	D
B	D	A	C
C	A	D	B
D	C	B	A
A	B	C	D
B	D	A	C
C	A	D	B
D	C	B	A
A	B	C	D
B	D	A	C
C	A	D	B

Results

Table I presents the composite results of all four groups of subjects, performing under both noise and quiet conditions, for the eight replications. It will be remembered that each group is composed of 15 subjects, each subject performing under both noise and quiet conditions for eight sessions. For instance, for Group A, in the cell under Day 1 and opposite Quiet, there are recorded 2581 responses. These represent the total number of responses for the 15 subjects in that group for Day 1 under the quiet conditions.

Intergroups Analysis

Figures 1 and 2 demonstrate graphically the data which are recorded in Table I. Specifically, the respective groups were compared with respect to performance changes under the Noise condition independent from performance changes under the Quiet condition. It is clear from Figures 1 and 2, that performance differences existed between the groups. It will be recalled that this was prior to the different experimental 'Set' which were not introduced until Day 2. Upon examination of the curves it is clear that several inversions have taken place. An analysis of covariance was computed for Day 2, Day 5, Day 6, and Day 8 to determine whether the existing gross differences were statistically significant from zero. The covariance analysis for each given experimental day was computed against Day 1, for which an initial performance measure was obtained prior to the introduction of experimental conditions on Day 2.

Tables II and III present a summary of the 8 covariance analyses. The asterisk indicates statistical significance at .05 level.

Intra-Group Trends: Cross-Over Analysis of Variance Design

The next operation was to consider the intragroup differences in relation to performance un-

TABLE IV

CROSS-OVER ANALYSIS OF VARIANCE FOR COMPARING THE PERFORMANCE OF GROUP A S's UNDER NOISE AND QUIET

	Replications								
Rows	1	2	3	4	5	6	7	8	Totals
First	Q172.06	N201.93	Q235.93	N270.00	Q279.26	N300.27	Q313.13	N277.33	2049.91
Second	N152.93	Q200.07	N224.27	Q263.93	N272.80	Q309.00	N301.93	Q280.60	2005.73
Totals	324.99	402.00	460.20	533.93	552.06	609.27	615.06	557.93	4055.64

Treatment totals: N2001.3; Q2054.1

Analysis of Variance

Source of Variation	d.f.	Sum of Squares	Mean Squares
Columns (replications)	7	36221.68	5251.59
Rows (first versus second)	1	123.21	123.21
Treatments	1	174.24	174.24
Error	6	560.05	93.34
Total	15	37079.18	

F-ratio for treatments = 1.86; not significant.

TABLE V

CROSS-OVER DESIGN FOR COMPARING THE PERFORMANCE OF GROUP B S's UNDER NOISE AND QUIET

	Replications								
Rows	1	2	3	4	5	6	7	8	Totals
First	Q187.06	N249.53	Q199.20	N286.73	Q220.13	N350.46	Q246.20	N424.80	2164.11
Second	N172.66	Q180.00	N244.26	Q230.06	N305.80	Q255.33	N325.06	Q280.46	1993.63
Totals	359.72	429.53	443.46	516.79	525.93	605.79	571.26	705.26	4157.74

Treatment totals: N2359.30; Q1798.44

Analysis of Variance

Replications	7	42043.20	6006.17
Rows (first versus second)	1	1806.00	1806.00
Treatments	1	19600.00	19600.00
Error	6	5456.83	909.48
Total	15	68906.03	

F-ratio for treatments = 21.55; significant at .01 level.

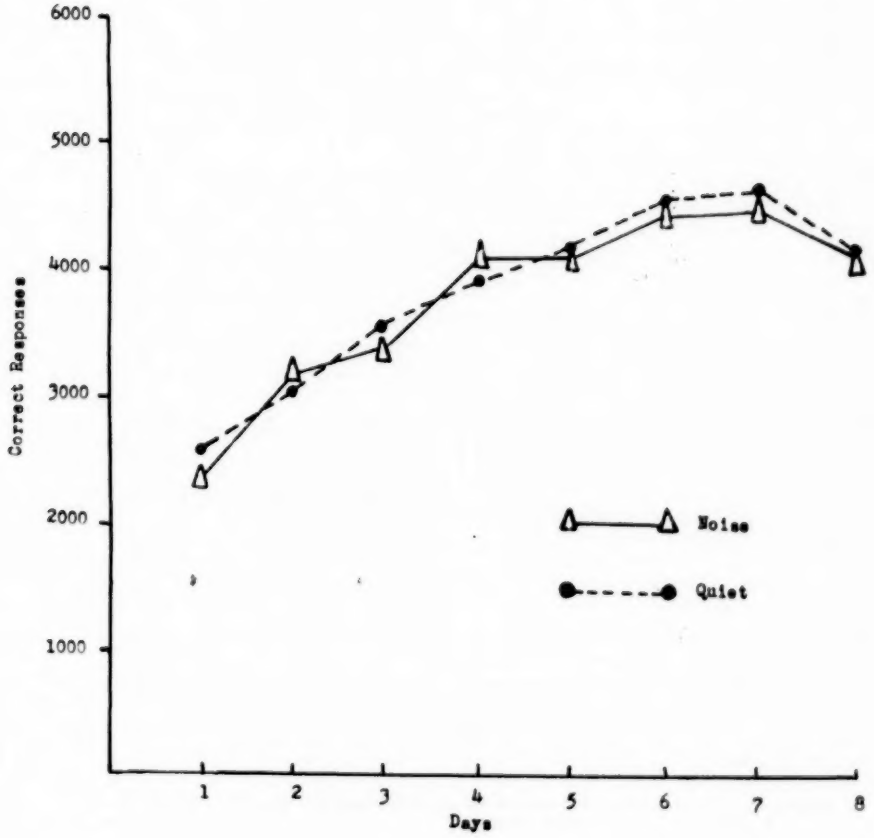


Figure 3. Performance Curves of Group A: Same S's Working Under Noise and Quiet Each Day

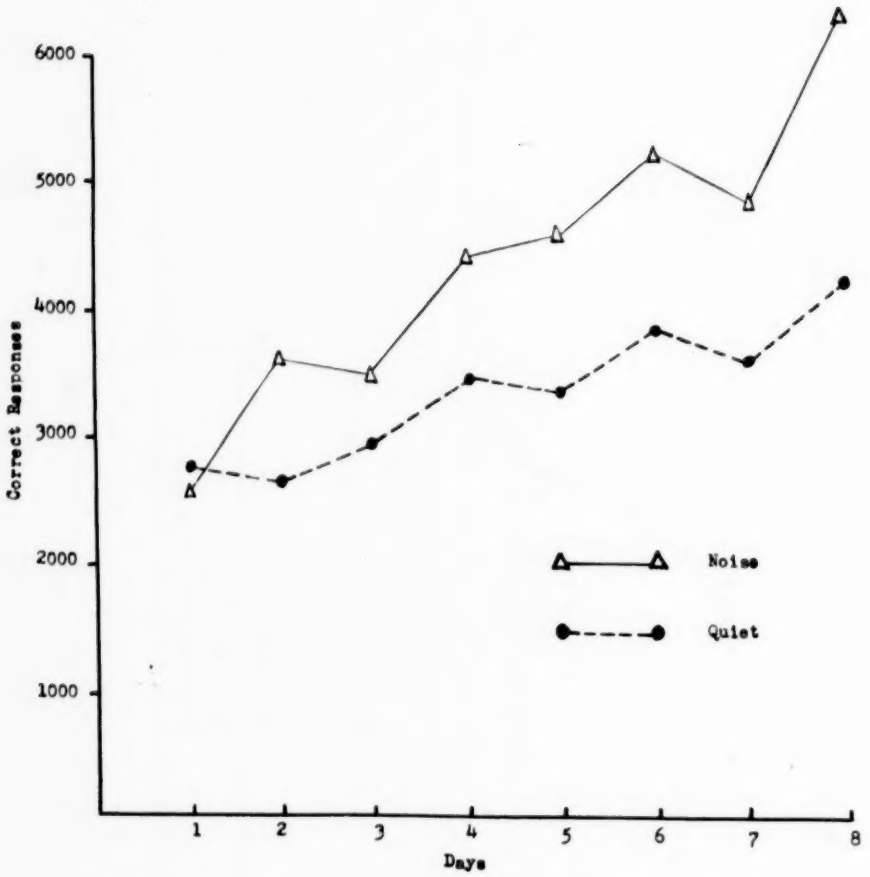


Figure 4. Performance Curves of Group B Subjects: Same S's Working Under Both NOISE and QUIET Each Day

der both Noise and Quiet conditions. Figures 3, 4, 5, and 6 present the performance curves of the four respective groups, i. e., the same S's working under both conditions. The comparative curves for each group are based upon the data found in Table I, the raw scores having been converted to mean scores.

Specifically, an analysis of variance was computed in order to determine the following points:

1. Group A S's were not given any instructions regarding the condition under which they were expected to perform better. Presumably, they proceeded under their own instructions. Basically, then, the point in question is whether there is a significant F value for trend toward better performance under one condition (Noise) or toward the other condition (Quiet).

2. Group B S's were given specific formal instructions regarding the condition under which the experimenter expected them to perform better; specifically, the defined noise condition, compared to quiet conditions. There was a trend, as is clear from Figure 4, toward accelerated performance under the noise condition. Does this trend represent a statistically significant difference from the performance of the same S's under the quiet conditions?

In similar fashion the analysis was made for Groups C and D. Cochran and Cox[1] point out that in biological assay a design has been used which closely resembles the latin square, but has some advantages when the number of treatments is small. In the simplest case, which we have here, there are two treatments, noise and quiet, which have been alternated in ABBA fashion. The design and computations used in the analysis are presented in Tables IV, V, VI, and VII.

Figure 3 presents the performance curves of Group A S's working under both noise and quiet conditions. Table IV presents the analysis of variance for Group A. The F-ratio for treatment of 1. 86 was not significant at the . 05 level.

It should be observed that in Figure 6, there is a cross-over in performance between Days 4 and 5, with Group D subjects gradually increasing their response rate under the noise condition, when compared with their responses under the Quiet condition. In theory, this cross-over was expected, and from the curves, Group D followed the trend predicted. Since the analysis of variance is a one-sided test, differences tend to disappear on both sides. It is clear from Figure 6 that differences on each side of the cross-over would balance out. To handle this problem it was decided to use a sample arithmetical artifact. The operation consisted of obtaining the differences between performance under noise from that under quiet for Days 5, 6, 7, and 8, and subtracting these differences for each of the cited days from the performance means under Quiet. It should be noted that the empirical data for Days 5, 6, 7, and 8 show Group D performing better under Noise than under Quiet condition; the result of the transformat on was to eliminate the cross-over and place the performance curve for noise the same distance below that of the quiet curve, as it originally was above it. The next operation was to carry out the analysis of variance which is summarized in Table VII. The F-ratio for treatments of 33. 70, for 1 and 6 degrees of freedom was statistically significant at the .01 level.

To summarize the results: (a) Group B subjects produced a significantly higher response rate under Noise conditions when compared with the three other groups; (b) Group C maintained a higher response rate under Quiet, but the difference was statistically significant at the . 05 level on only two of the four covariance analyses; (c) Groups B and C performance deteriorated somewhat during the 72 hour interval between Days 5 and 6; (d) in comparing the intra-group trends Group A produced no significant differential response rate in either direction. Groups B and C produced statistically significant differential overall response rates. Group D also produced a statistically significant differential response rate over the eight sessions. This difference was indicated after the arithmetical transformation had been completed in order to "eliminate" the cross-over.

Discussion of the results. —Unfortunately, there is a lack of systematic data with which to compare the cited results. The reference here is to overt performance changes, and not to physiological measures such as GSR's or action potential measures, mention of which will be made later in the discussion.

The intergroups analysis will be considered first. The instructions seemed to have an immediate effect upon the performance of the subjects. The various inversions of the groups from Day 1 - 2 under Noise was significant at the . 05 level with an over-all F-ratio of 7. 87. Group B was clearly trying harder under the Noise condition, while Group C appeared to be depressing their performance when the Noise condition was introduced. The various groups maintained their relative rank order on the curves for Days 3 and 4 with Group D gradually increasing their response rate under Noise. This seems to be one explanation for the somewhat lowered covariance F value of 3. 81 between Days 1 - 5 under Noise. The S's in Group D, it will be recalled, were oriented by the form-

1. W. G. Cochran, and G. N. Cox, Experimental Designs (New York: John Wiley & Sons, 1950).

TABLE VI

CROSS-OVER DESIGN FOR COMPARING THE PERFORMANCE OF GROUP C S's UNDER NOISE AND QUIET

	Replications								
Rows	1	2	3	4	5	6	7	8	Totals
First	Q158.06	N180.13	Q264.06	N220.00	Q352.46	N252.13	Q343.73	N262.26	2032.83
Second	N198.40	Q223.20	N210.40	Q274.86	N256.26	Q309.53	N271.73	Q331.20	2075.58
Totals	356.46	403.33	474.46	494.86	608.72	561.66	615.46	593.46	4108.41

Treatment totals: N1851.11; Q2257.10

Analysis of Variance

Source of Variation	d.f.	Sum of Squares	Mean Square
Replications	7	33438.10	4776.87
Rows (first versus second)	1	114.10	114.10
Treatments	1	10302.25	10302.25
Error	6	5587.29	932.88
Total	15	49451.74	

F-ratio for treatments = 11.04; significant at .01 level.

TABLE VII

CROSS-OVER DESIGN FOR COMPARING THE PERFORMANCE OF GROUP D S's UNDER NOISE AND QUIET

	Replications								
Rows	1	2	3	4	5	6	7	8	Totals
First	Q174.13	N161.66	Q220.80	N222.46	Q213.13	N221.00	Q272.20	N207.46	1692.84
Second	N167.60	Q208.13	N182.00	Q245.40	N180.80	Q276.00	N237.60	Q280.53	1778.06
Totals	341.73	369.79	402.80	467.86	393.93	497.00	509.80	487.99	3470.90

Treatment totals: N1580.12; Q1890.32

Analysis of Variance

Source of Variation	d.f.	Sum of Squares	Mean Square
Replications	7	14368.54	2052.65
Rows (first versus second)	1	453.70	453.70
Treatments	1	6014.00	6014.00
Error	6	1067.64	177.96
Total	15	21903.88	

F-ratio for treatments = 33.70; significant at .01 level.

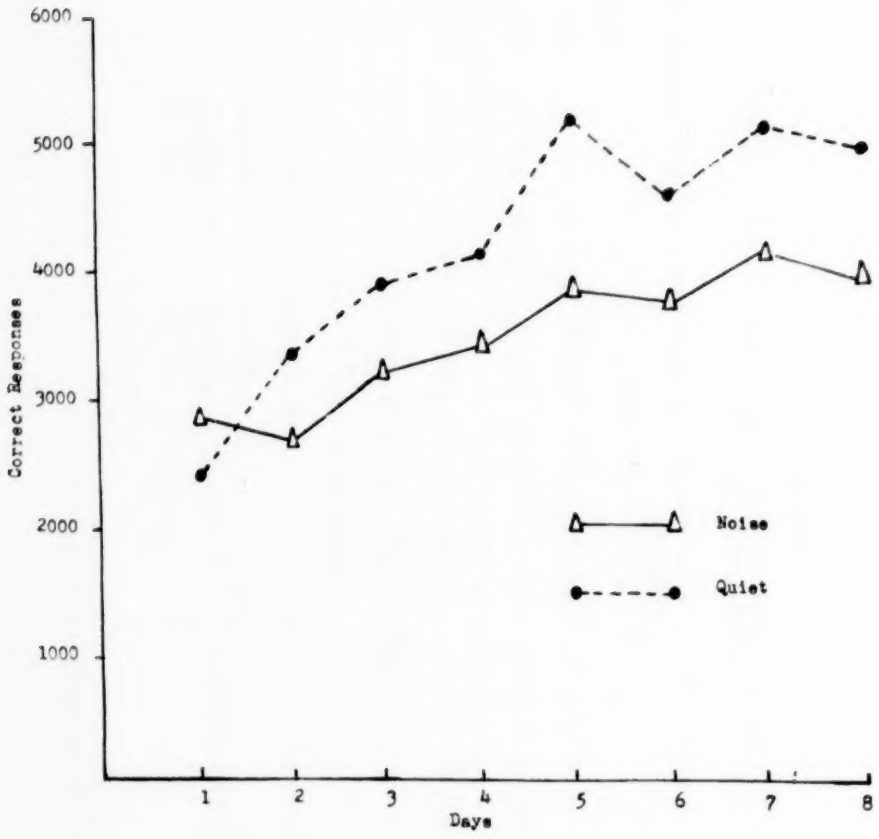


Figure 5. Performance Curves of Group C: Same S's Working Under Both NOISE and QUIET Each Session

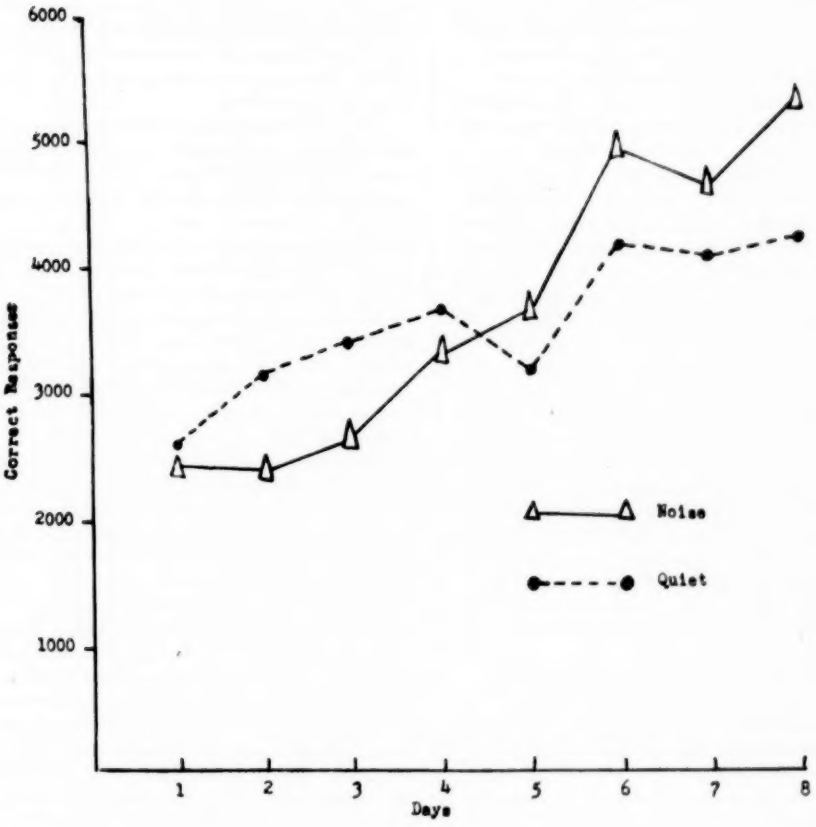


Figure 6. Performance Curves of Group D: Same S's Working Under Both NOISE and QUIET Each Session

al instructions that they were expected to perform better with the Noise condition after the first 3 or 4 days, but were expected to perform better at first without the Noise.

The F value of 1.2 between Days 1 - 6 under Noise was clearly not significant. This introduces an important factor. It will be recalled that between experimental Days 5 and 6 there was a 72 hour interval which can be termed the "weekend break" between Friday (Session 5) and Monday (Session 6). This result seemed to suggest that the orientation that the Group B S's were given toward performance under Noise had deteriorated to a large degree during this 72 hour interval.

Group B performance decreased to a greater extent on Day 7, but on the final test Day 8, Group B performance was again significantly higher than that of the other three groups. One principle low level explanation of this occurrence might be that the S's in Group B were aware that Day 8 was the last session in which they would be required to perform the routine task, and were saving their "best" performance for that day. The S's in this group were instructed that they should be doing progressively better under Noise on each trial, and it is entirely possible that they were attempting not to 'burn themselves out' before Day 8.

In any case, Group B performance, on the whole, showed a significant trend toward better performance under the Noise condition. This is particularly evident when the work curves under both Noise and Quiet for Group B are compared. The analysis of variance in the cross-over design shows an F value for the "treatments" of 21.55 with a probability of less than .01. Figure 4 shows Group B as having performed slightly better under quiet conditions than under Noise on Day 1 (initial measure). This difference, however, was not statistically significant. On Day 2 there was an inversion and Group B did consistently better with the Noise. It is not untenable to suppose that these S's depressed their response rate with the record off. One female subject in this group reported that the reason for her better performance under Noise was that she was 'compelled' to add faster in order to keep from hearing the record.

The evaluation of such judgments is clearly not within the scope of this investigation. It is recognized that there is probably a multitudinous number of reasons that particular S's could give for their respective performances. However, in general, these could not be verified. Some typical reasons that were given for what some S's thought was a poor showing were: "I'm tired from studying"; "I have a test tomorrow, and can't think of anything else"; "I'm a pledge and my fraternity or sorority made me do such and such a thing today."

It is clear that the subjects used in the investigation were not in the same physiological condition from day to day. On one day a subject would appear cheerful and enthusiastic about the task; on another day the same subject would come into the experimental room, and give the impression that this was just another routine duty to perform. Clearly, these judgments are made from the experimenter's standpoint, and should not be interpreted as absolute in any sense. It is entirely possible that the investigator himself was not in the same physiological state on succeeding days.

Group C subjects produced a higher daily response rate under quiet conditions, but differences were statistically significant in only two of the four covariance analyses under the quiet conditions. As was pointed out with Group B under Noise, the Group C performance under Quiet appeared to deteriorate in the 72 hour interval between Days 5 and 6. This occurrence suggests that if instructions are to be an important variable in this particular type of work task, that frequent reinforcements with the particular set of instructions is desirable. If this condition is not fulfilled it would appear that extinction of the desired effect would soon take place.

An important phase of the analysis was embodied in the comparisons that were carried out between the four groups, separately, to determine whether each group showed any significant trend to perform differentially better under one condition than under the other. Group A were told only that they were serving in an experiment on the effects of noise. The analysis shows no significant trend in either direction in favor of Noise or Quiet. This group, as with the others, probably brought some bias into the experimental room toward one condition or the other. There was a slightly higher response rate for Group A under the Quiet conditions, but the difference was not significant. The implication here is that these subjects were not differentially disturbed by the noise condition.

Group B subjects, having been oriented toward a higher response rate under noise, produced a significant trend in that direction. Noise, here, certainly had no inhibiting effects. Group C produced a differentially significant trend toward better performance under the quiet condition; while Group D, which received the 'complex' instructions, produced a significant trend toward better performance under quiet at first, with a gradual increase in response rate under noise toward the later sessions.

Analysis of the data indicate that:

1. Formal instructions, or giving the subject an orientation as to what direction to work in, appears to be a significant variable in relation to

routine production tasks. In order to produce differentially significant results, and eliminate vascillation of performance, the major property of these instructions seems to be that they be clear cut, and orient the subject in a precise direction.

2. Once the desired direction is produced, the evidence seems to indicate that frequent instructional "reinforcements" are necessary to maintain superior performance in that direction. At least, in relation to the routine verbal addition task employed.

3. Verbal Noise, per se, of a given intensity, does not appear to have any necessary effect upon the execution of routine work tasks. This finding seems compatible with some physiological results—that subjects gradually become adapted to the noise.

4. There is no consistent difference in production when no effort is made to give subjects formal instructions with respect to the conditions under which they are expected to perform better.

Speculations. —At the expense of over-extrapolating from the empirical data the investigator believes it advisable to make some comment, under the above heading. Although this investigation has been classed as a "work" experiment, this terminology has not been used to imply that the variables important for work tasks would not also be important for learning. Unfortunately, there are few systematic data in reference to this.

Although the present investigation did not deal with control over the subjects' past experience, reference might profitably be made to Harlow's[2] data on building generalized 'learning sets' in monkeys. All the studies used a non-correction method—a method somewhat analogous to the present study, in which the S's were not informed as to their progress, or when they had made an error. Even though the monkeys were necessarily wrong on about 50 percent of their first choices, they were able to learn object discriminations from both their failures and their successes. Harlow designates this learning how to learn a problem, as a learning 'set,' and concludes that a knowledge of the nature of learning sets, could be of such importance to educational theory and practice, as to justify a prolonged and systematic investigation.

The acceptance of infra-human studies has the important advantage of allowing us to derive certain testable principles in relation to human behavior. The difficulty here is that there is the verbal factor to contend with, and the problem is more basic than Harlow proposes.

One might be justified, at this point, to ask what can educational theory profitably derive from this discussion? There appears to be one obvious point: educational institutions, in a general sense, are continually employing the 'directional' technique. Teachers at all levels are continually directing (mostly verbally) learning situations with the hope that by virtue of this process the pupil has been aided in selecting the direction wherein he should apply his efforts. The data of the present investigation indicate that 'instructions' are a variable to be considered in repetitive tasks, if performance shifts in a certain direction are desired. This leaves many facets of the problem unanswered: (1) Are the instructional effects relatively temporary? (2) Are schedules of instructions instrumental in producing differential effects; i. e., introducing the particular set of instructions during each period, or introducing them in intermittent fashion, or at an a-periodic interval?

A note of caution should be introduced at this point with respect to the interpretations of the results of the many educational "methods" investigations.

A teacher might be so convinced that one educational method was superior to another that his enthusiasm for the method would so influence the subjects that they would actually do much better under it than under its competitor. But another educator could easily be so sincerely convinced of the superiority of the rival method that he in turn could prove his method to be the better one. Now which really is the better method?

---

2. H. F. Harlow, "The Formation of Learning Sets," Psychological Review, LVI (1949), pp. 51-65.

INTERGROUP ATTITUDES AND EXPERIMENTAL CHANGE

MARGARET L. HAYES
MARY ELIZABETH CONKLIN
New York State College for Teachers
Albany, New York

Purposes and Background

DURING THE years 1945-46 and 1946-47 the New York State College for Teachers was one of the participants in the College Study in Intergroup Relations which was sponsored by the American Council on Education and financed by the National Conference of Christians and Jews, under the direction of Dr. Lloyd A. Cook. This study is one of several projects undertaken by the faculty committee on intergroup education at this College. It was undertaken with the following purposes: (1) to determine the quality and extent of some desirable changes in intergroup attitudes that can be brought about in adolescents through directed teaching; (2) to determine the relative effectiveness of different types of teaching; (3) to find how response to attempts to change attitudes is related to membership in groups determined by age, sex, intellectual level, religious affiliation, and cultural background. Attempts were made to change attitudes toward problems of the Jew, Negro, and immigrant and toward the slum problem. Since the work of the two years was with different age levels and with different methods of evaluation, it seems less confusing to discuss the work of each year separately and then bring together the findings at the end.

THE FIRST YEAR PROJECT

Subjects and Setting

The schools which were asked to join in the project represented different types as to purposes and characteristics of their student bodies. School A is a private girls' school; nearly all of the pupils have American-born parents; there is a mixture of Protestants, Catholics and Jews; the economic level is high. School B is a consolidated village-rural public school; Protestants predominate; the economic level is good; nearly all parents of the students are American-born. School C is the campus school in connection with the teachers college; there is a larger percentage of Jewish children in this school than in the other schools, but the majority are Protestant. School D is a large city public school; it has many children with foreign-born parents and many with poor economic backgrounds; there is a mixture of religious groups and this is the only one of the schools that has Negro students; also, many of the students are over-age. The study was confined to tenth grades in these schools and in each school there was an experimental group, (X), and a control group, (C). Both groups were taught, except in one instance, by the same teacher. There were 103 boys and 106 girls involved in the whole project. Teachers for this project were carefully chosen because of their interest in inter-group education and their demonstrated expertness in instruction. The teacher in School A taught Biology; the two in School B taught Social Studies and English, respectively; the teacher in School C taught English and the one in School D Social Studies.

Procedures

Several conferences were held with teachers to plan the organization and evaluation of the study; the national director assisted with some of these. The teachers working on the study agreed that the general aim was to improve intergroup relations in their classes and that the specific aims for pupils were: (1) to grow in social sensitivity and understanding concerning problems of relationships between economic, racial and religious groups; (2) to learn techniques for living satisfactorily with members of other groups. The participants felt that this involved seeing the problems of less favored peoples, being appreciative of contributions regardless of race, religion or national origin, being aware of the ways by which other people are hurt, and seeing people as individuals rather than as members of a class.

Each teacher selected a different technique to use with the experimental class, and planned a unit of subject matter. Particular effort was made to find material which could be a natural part of the existing course of study. This was to prevent the anticipated criticism that the study was not concerned with the real business of the school and to make it possible to work for the improvement of attitudes without arousing any unnecessary excitement in the pupils. To reduce

the possibility of the pupils regarding themselves as "guinea pigs" all pupils in the tenth grade were given the tests and in most cases the experimental unit was given to other pupils in the grade after the study was completed.

A brief summary of the various methods used is given below:

1. School A. The teacher used biographies of scientists in both X and C classes but used for her X group scientists of different nationalities and races. Each student read and reported on the contribution of some man or woman to science. Each student also made a written report on source material.
2. School BI. This unit was a study of "Religions in America". The teacher used research followed by panels and later by informal class discussions. The class agreed to use Protestant, Catholic, Jewish, Mormon, Quaker, and minor religious sects as their field of study.
3. School BII. The teacher used the play, "The American Way" by Kaufman and Hart, already a part of the course of study, as the springboard for discussion. The aim of instruction was to encourage thinking in terms of individuals rather than class through a recognition of the "American Way" of equal respect and opportunity for persons of all races, creeds, and nationalities. The class read and decided to memorize "And No One Asked" by Morris Reich; later this was given as a choral reading in assembly.
4. School C. The teacher in School C used a class discussion of Hortense Powdermaker's Probing Our Prejudices and followed this by class and individual reading of short stories and novels.
5. School D. Lectures were given on "The Growth of Democracy". The teacher selected and emphasized those historical events which had a direct bearing on the aims of the experimental study, such as the federal Constitution, the Preamble, the Bill of Rights and the Amendments. Considered also were the setbacks to democracy, such as the poll tax. Anti-discrimination laws and the F. E. P. C. were also included. It will be noted that in Schools A, BI, and D the approach could be characterized as intellectual; in Schools BII and C much use was made of vicarious experience.

Two kinds of evaluation techniques were used with the ten sections involved in the project. Two tests were part of the "Social Problem Analysis, Advanced Series".[1] One of these tests dealt with attitudes toward problems of the Negro and the other with attitudes on slum problems and each had four subdivisions: (1) Reasons for delay in attacking the problem; (2) scope of the problem; (3) what to do about the problem; and (4) hope of progress in solving the problem. The scoring values were obtained by combining the judgments of the teachers involved in the study with those of the members of the faculty committee on intergroup education at the college. The second technique was a sociometric device, "The Social Acceptance Scale".[2] It required pupils to indicate their choices of people they would like best as friends and those they would not care to have as friends. A data sheet was filled out for each child giving age, nationality, race, religion, birthplace of parents, father's occupation, economic background, mental level and other identifying data. The two social analysis tests and the Social Acceptance Scale were administered to the pupils during the last week in October. The experimental teaching was then done for three weeks and the pupils tested again.

Analysis

The analysis that follows is in terms of what changes took place during the period of experimental teaching. The test data are treated first, then the sociometric data. The data are examined in terms of: experimental and control groups, methods used, and groups determined by the school, cultural groups, and sex of pupils. The following groups were considered important from the standpoint of cultural background and so designated: children whose parents were born in this country (old-stock Americans) O; children, one or both of whose parents were foreign-born (new-stock Americans) F; Jewish Americans, J; and Negro Americans, N. These classifications are functional rather than logical. Pupils were considered under-age if they were more than a year younger than 15 years 2 months, the expected age for this group; over-age if they were more than a year older than the expected age. Children with IQ's 90-110 were considered average; those above this level high; those below, low.

Table I gives average changes in scores on Social Analysis Tests by schools and by experimental and control groups.

Table II gives the percentage of pupils in each group who improved in attitudes as indicated by scores on the Social Problem Analysis Tests.

The total X group made a change of +1.8 in total attitude; the C group made a change of +.4.

1. This is a mimeographed test series obtained from the Bureau of Educational Research, Ohio State University.

2. Published by Ohio State University.

TABLE I

AVERAGE CHANGES IN SCORES ON SOCIAL ANALYSIS TESTS BY SCHOOLS AND EXPERIMENTAL AND CONTROL GROUPS

	Negro Problems					Slum Problems					
Group	1	2	3	4	T	1	2	3	4	T	T
AX	+ .8	+1.0	- .1	+1.5	+3.0	+ .4	-1.1	- .6	-1.9	-3.3	- .3
AC	- .1	0	+ .9	+1.4	+2.5	+ .7	- .2	- .3	+1.6	+1.8	+4.2
BIX	- .6	+ .6	- .3	0	- .2	+ .6	- .2	+ .4	+ .4	+1.3	+1.1
BIC	0	+ .2	- .2	+ .2	+ .9	+ .1	0	0	- .3	- .2	+ .6
BIIX	+1.0	-1.6	- .5	+ .7	- .4	+ .3	+ .2	0	+ .6	+1.3	+ .9
BIIC	+1.2	+ .3	+ .7	+ .4	+2.7	+ .2	-1.1	- .7	-2.0	-3.4	- .9
CX	- .4	+ .8	- .5	+2.0	+1.9	0	+ .6	+ .9	- .9	+ .5	+2.5
CC	- .1	+ .2	+ .3	- .1	+ .4	+1.8	+ .2	- .4	-2.1	- .5	0
DX	- .5	- .6	+ .4	+1.2	+ .7	+ .2	+ .1	+ .7	- .2	+1.0	+1.6
DC	+ .4	+1.0	- .5	+1.5	- .2	- .2	- .2	- .2	- .9	- .6	- .2
Total C	- .4	+ .4	+ .2	+ .5	+ .9	+ .4	- .1	- .4	+ .1	- .6	+ .4
Total X	0	0	+ .1	+1.0	+1.2	+ .3	+ .2	+ .4	+ .2	+ .7	+1.8

TABLE II

PERCENTAGES OF PUPILS WHO IMPROVED IN ATTITUDES ON SOCIAL PROBLEMS

Group	Negro	Slum	Total
AX	64	36	64
AC	46	54	61
BIX	41	68	60
BIC	41	48	53
BIIX	41	44	44
BIIC	67	24	33
CX	57	39	57
CC	45	32	41
DX	57	61	74
DC	13	42	33

Change in the X group was great enough to indicate that it was not due to chance; that in the C group was not. For differences within the whole group an average difference of 1.0 gives T = 1.95; this is at the 5% level of significance. In all schools there were larger percentages of pupils in the X groups who improved in attitudes than there were in the C groups. A consideration of separate groups and separate problems shows many discrepancies; this is probably an indication that there were important factors not under the control of the experimenters. School C seemed to be most successful when both problems were considered together, followed by Schools D and B (Group I). Result from Schools A and B (Group II) were inconclusive. On the Negro problem School A was most successful, followed by School C. On the slum problem School B, Groups I and II, secured best results, followed by School D; for other groups results were inconclusive or indicated an actual loss in attitude. It would appear that the procedures for changing attitudes were successful in an overall manner, but there is no clearcut evidence that one method is more successful than another.

Table III shows the percentages of pupils by sex in X and C groups who showed improvement in attitude.

TABLE III

PERCENTAGES OF BOYS AND GIRLS SHOWING IMPROVEMENT IN ATTITUDE ON SOCIAL ANALYSIS PROBLEMS

	X			C		
Problem	B	G	T	B	G	T
Negro	40	60	50	53	26	14
Slum	60	45	30	37	39	29
Total	54	65	60	43	41	29

A larger percentage of girls improved in attitude in the X group; there was little sex difference in total scores in C group. With the exception of boys on Negro problems, all X groups showed more improvement than C groups.

Table IV gives the average changes in scores on Social Problem Analysis Tests by Cultural groups.

In all cases, cultural groups in the control sections were at the beginning of the study superior in the intergroup attitudes investigated to cultural groups in the experimental sections. In the beginning Jewish Americans displayed most favorable attitudes in both X and C groups as compared to old-stock Americans and new-stock Americans, on both types of problems; the old-stock American group showed more favorable attitudes on Negro problems than did the new-stock American group. In total attitudes the new-stock American X group made the most gain, 5.4 points; the Jewish American X group came next with a total gain of 4.2 points; other total gains were .6 points or less. On the attitudes toward Negro problems the greatest gain was by the new-stock American X groups; the next greatest gain was by the Jewish American X groups; little gain was made by the old-stock American group or by any of the control groups, with the possible exception of the old-stock American which showed a change which approaches significance. Results on attitudes toward the slum problems followed the same pattern but were not as marked.

Table V shows percentages of pupils who improved in attitude according to intelligence groupings.

The high and average intelligence X groups both contained a higher percentage of pupils who improved in attitude than did the C high and average groups. There seemed to be little difference in the amount of improvement made by high and average intelligence groups. There were only nine pupils in the low intelligence group; this is probably too few to warrant any conclusions.

The sociometric data was used to reveal the child's adjustment to the social group which constituted the section of which he was a member. It sheds light on intergroup attitudes when groups include in their choices members of different cultural groups. Table VI is a summary table of sociometric data obtained for all the groups of this study. Results are group averages. Column 3 indicates changes in the average numbers of acceptances of others or group expansiveness; column 4 gives the changes in the average numbers of rejections of others; column 5 contains the changes in the average numbers of mutual acceptances; column 6 gives the changes in the average numbers of mutual rejections; column 7 indicates the changes in the numbers of cases where liking is extended but not returned. Since the number of first choices is somewhat affected by the number of people for whom choices of one kind or another must be given, the last three columns contain changes in the indices of liking, hostility, and of outgoingness respectively. These indices were obtained by dividing the total number of acceptances and rejections of others by the total possible number of choices or rejections and combining these two figures for use in the last column. Plus signs indicate an increase in numbers during the time of experiment; minus numbers indicate a decrease in numbers during the same period. In the discussion of the separate groups that follows this table is used for comparative pur-

TABLE IV

AVERAGE CHANGES IN SCORES ON SOCIAL ANALYSIS TESTS BY CULTURAL GROUPS

Cultural Group	Old-Stock American		New-Stock American		Jewish American	
Group	X	C	X	C	X	C
Number	87	69	11	20	11	7
Negro	+ .3	+1.2	+3.5	+ .7	+2.7	0
Slum	0	+ .1	+1.9	-1.8	+1.5	-1.1
Total	+ .3	+ .6	+5.4	-1.1	+4.2	-1.1

TABLE V

PERCENTAGES OF INTELLIGENCE GROUPS IMPROVING IN ATTITUDES

	High (over 110)		Average (90-110)	
Problem	X	C	X	C
Negro	53	42	55	49
Slum	53	40	48	42
Total	51	44	58	54

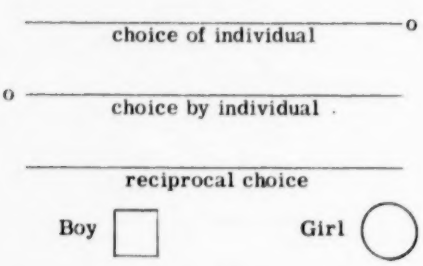
TABLE VI

CHANGES IN GROUP ORGANIZATION SHOWN BY SOCIOMETRIC DATA

Group	No.	Acc.	Rej.	M. A.	M. R.	R. A.	I. L.	I. H.	I. O.
AX	14	+.5	- .5	0	0	+.06	+.039	-.033	+.006
AC	13	+.7	+ .1	+.60	0	0	+.060	+.007	+.067
BIX	30	0	- .9	+.10	-.30	-.07	0	-.031	-.031
BIC	18	-.6	-1.0	-.50	-.17	-.28	-.026	+.010	-.016
BIIX	28	-.1	0	+.14	+.36	-.03	-.004	-.001	-.005
BIIC	22	-.1	- .1	-.05	-.09	0	-.001	-.007	-.008
CX	23	+.8	- .3	+.56	0	-.04	+.037	-.016	+.021
CC	22	-.4	+ .1	-.28	+.13	+.05	-.017	+.004	-.013
DX	24	+.3	-1.8	+.10	-.27	0	+.013	-.071	-.058
DC	26	0	- .6	-.19	-.15	-.12	+.001	-.023	-.022

poses.

Figure 1 and figure 2 are sociometric charts showing the social organization of groups AX and AC respectively at the beginning of the experiment. Here, as in the charts that follow, pupils are referred to by number and the following legend is used:



Old-stock American, A; American of foreign parentage or new-stock American, F; Jewish American, J; Negro American, N.

Group AC was characterized by a very high degree of social organization. This was shown by high emotional expansiveness, very little hostility, high positive reciprocation and no frustration from unreturned liking. Also there was one very strong leader, Number 1, who was strongly allied with other leaders; Numbers 7 and 10. This is shown in Figure 2. During the instructional period this social organization developed further, as shown by increased emotional expansiveness and more positive reciprocation. Also, another leader, Number 12, arose. Group AC appeared to make more progress in social development than did Group AX. This is shown in Table VI and in Figure 3.

Groups BIX and BIC showed a similar and rather high degree of social development at the beginning. Group BIX became somewhat better organized, as shown by an increase in the number of mutual acceptances. Group BIIX was better organized than BIIC; neither showed much change. Group CC was better organized at the beginning; Group CX gained more in liking and decreased more in hostility than did Group CC. The pattern of Group CX at the beginning is shown in Figure 4. There is a marked sex cleavage. The two interlocking cliques of girls is interesting; clearly the Jewish American girl Number 3 is the key figure in the feminine group organization. Isolation and rejection in this group does not appear to be based on majority-minority group factors.

The two groups in School D presented in the beginning a marked contrast. Group DC was better developed socially; it had more emotional expansiveness, more mutual reciprocation and less mutual rejection and hostility in general. Group DX made more progress in social development than did Group DC. School D is the only one that has a considerable number of Americans of foreign-born parentage as well as Jewish Americans and Negro Americans. The social organization of Group DX is shown in Figure 5. There is a sex cleavage, but not as marked as that shown in Figure 3. Choices do not appear to be based on majority-minority group relationships to any large extent.

Findings from the First Year of the Project

1. The experimental groups as a whole made more progress in the development of favorable attitudes on the problems tested in the study and in group social development than did the C groups as a whole. This was true of almost all individual groups; this indicates that the experimental teaching was successful in changing attitudes in desirable ways. The total change and the change in attitude toward Negro problems were significantly large; the change in attitude toward slum problems may be due to chance.

2. As to separate methods used, the one employed in School C appears to be the most effective in changing attitudes in favorable directions. It will be recalled that this method was one vicarious experience through reading short stories and novels in connection with Powdermaker's "Probing Our Prejudices". However, the discrepancies in scores from various groups indicate that no clear-cut claim can be made for the superiority of one method over another; the results are affected by the type of problem under consideration and probably by other factors also.

3. Girls improved more than did boys in attitudes toward Negro problems.

4. New-stock Americans made the greatest gains in the direction toward favorable attitudes; the Jewish American group made the next largest gain.

5. There was no apparent difference in gains made by pupils of high intelligence as compared with those of average intelligence.

THE SECOND YEAR PROJECT

Subjects and Setting

The subjects for this project were the eighth grade pupils in five schools in and near Albany,

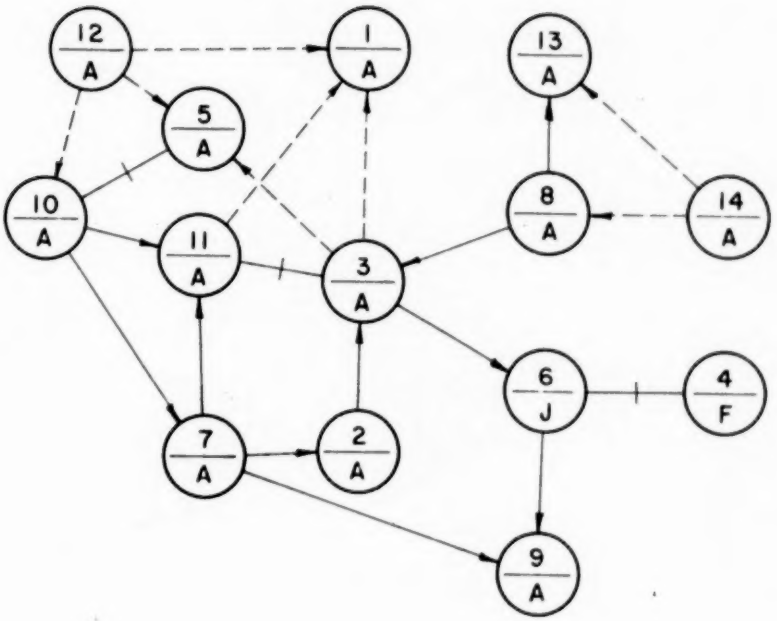


FIG. 1

SCHOOL A, GROUP X

BEGINNING OF EXPERIMENT.

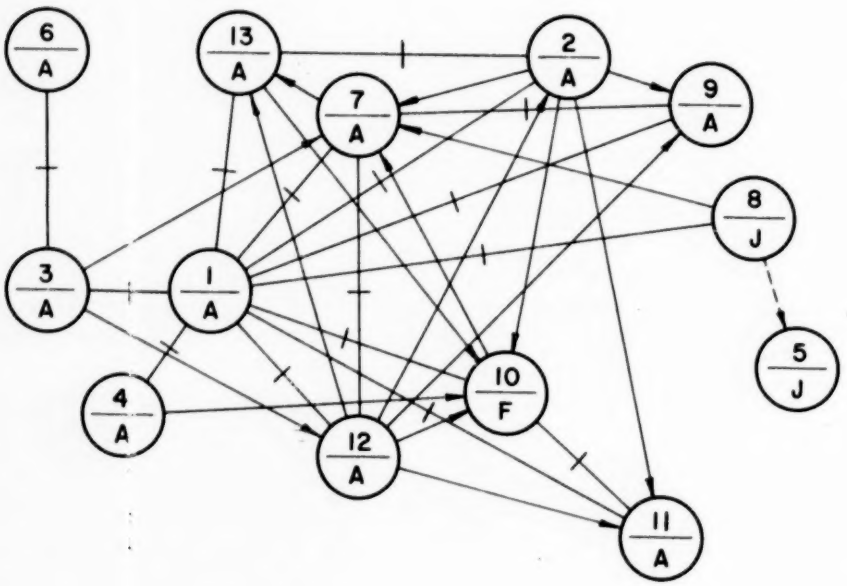


FIG. 2

SCHOOL A, GROUP C

BEGINNING OF EXPERIMENT

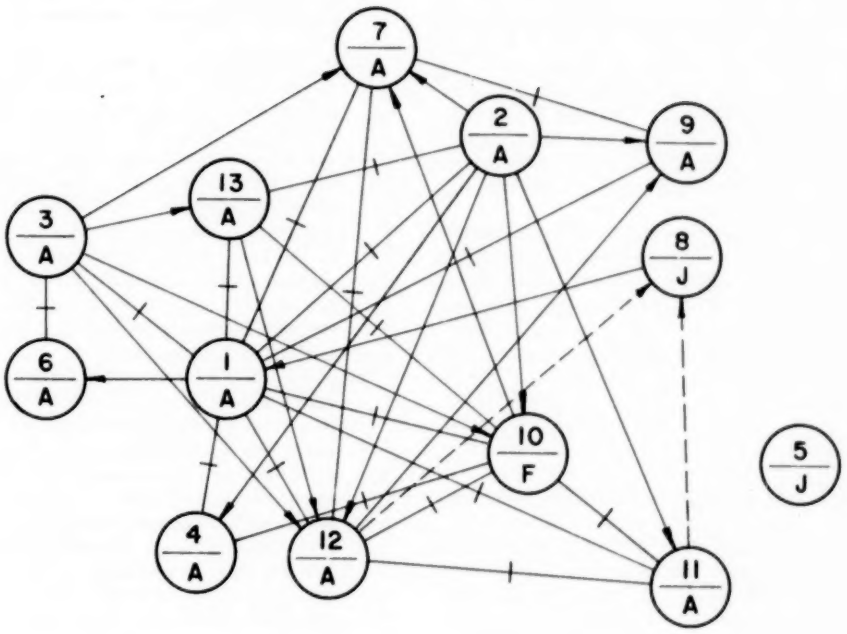


FIG. 3

SCHOOL A, GROUP C

END OF EXPERIMENT

New York. These schools may be briefly described as follows: School F is a consolidated village-rural school; the economic level is good; all pupils are Protestant; nearly all are of old American stock. School G is a consolidated village-rural school; there are a few Jews and Catholics, but Protestants predominate; the economic level is good. School H is a large city junior high school; there is a mixture of cultural groups; the economic level is low; Protestants predominate but there are many Catholics. School J is a medium sized city school; nearly all pupils are of old American stock; there are about equal numbers of Catholics and Protestants. School K is a village school; pupils of old American stock predominate but there are quite a few whose parents are foreign born; Catholics predominate and there is only one Jew in the grade.

There were 117 boys and 115 girls included in the study, distributed in cultural and religious groups as follows: both parents American born or old-stock American, (O) 185; one or both parents foreign born, or new stock American, (F) 20; Jewish Americans, (J) 13; Negro Americans, (N) 14; Protestant, (P) 131; Catholic, (C) 78; religion unknown, (?) 10.

Procedures

In each school an experimental (X) group was given special teaching and a control group (C) was not. Both groups were tested at the beginning and end of a three weeks period during which the instruction took place. In setting up the instruction the projects were planned to fall into one of three categories, with a view to getting at fundamental approaches, rather than specialized techniques. These categories are described below:

1. Direct experience: members of various minority and majority groups working and playing together in activities with common purposes and interests.

2. Intellectual approach: The theory here is that if one knows the truth about characteristics and achievements of minority groups, prejudice against them will disappear.

3. Vicarious experience: Here one approaches real experience by projecting himself into the character of a minority group member by reading, acting or listening to something of strong emotional nature.

A series of three meetings was held with the participating teachers and some supervisors and principals to discuss methods, acquaint them with further materials and to plan evaluation. Instructions to teachers were as follows:

1. School F. Study the contributions of the Jew, Negro, and immigrant to history. Use a dramatic emphasis here to cause the children to project themselves into the charcters of Jews, Negroes and immigrants. Use factual material presented through discussions or biography, leading to the dramatic expression. Make a great deal of their contributions in the last war.
2. School G. Make a study of the contributions of the Negro, Jew and immigrant to literature, music and art. Make this factual and intellectual in nature. Use biography, lecture, discussion, forums, posters, factual movies and recordings or required readings but avoid plays or any type of procedure that will cause the child to project himself into the character of the Jew, Negro or immigrant. See that the children know and understand what Jews, Negroes and immigrants have accomplished. Marian Anderson and others will be good material for this project.
3. School H. An attempt should be made here to cause children to understand the scientific basis for group understanding. Let them learn the scientific facts of race. Use also contributions of scientists who are Jews, Negroes or immigrants. Use any or all of the following: biography, lectures, discussions, forums, posters, assigned readings, factual movies, and recordings. This is an intellectual approach, so avoid drama. Do not use a method where the child projects himself into the character of a minority group member, as he would do in a play or movie or in reading fiction. George Washington Carver is an illustration of a person to be studied.
4. School J. Make a study of the Jew, immigrant and Negro through literature. Read and study plays, fiction and poetry about these peoples, but not what they themselves have written. Include plays on racial questions. Let children have the vicarious experience of projecting themselves into the minority group characters in these plays, fiction and poetry.
5. School K. Set up a cooperative project in which members of various majority and minority groups work together to make a success of something. The scheme followed might be similar to that described in Stewart Brown's "They See for Themselves". Study origins and characteristics of groups represented in your groups and have children write and produce a play for presentation in assembly or elsewhere. Work for direct participation in a cooperative effort.

It will be noted that methods used by Schools G and H were intellectual in approach; those used

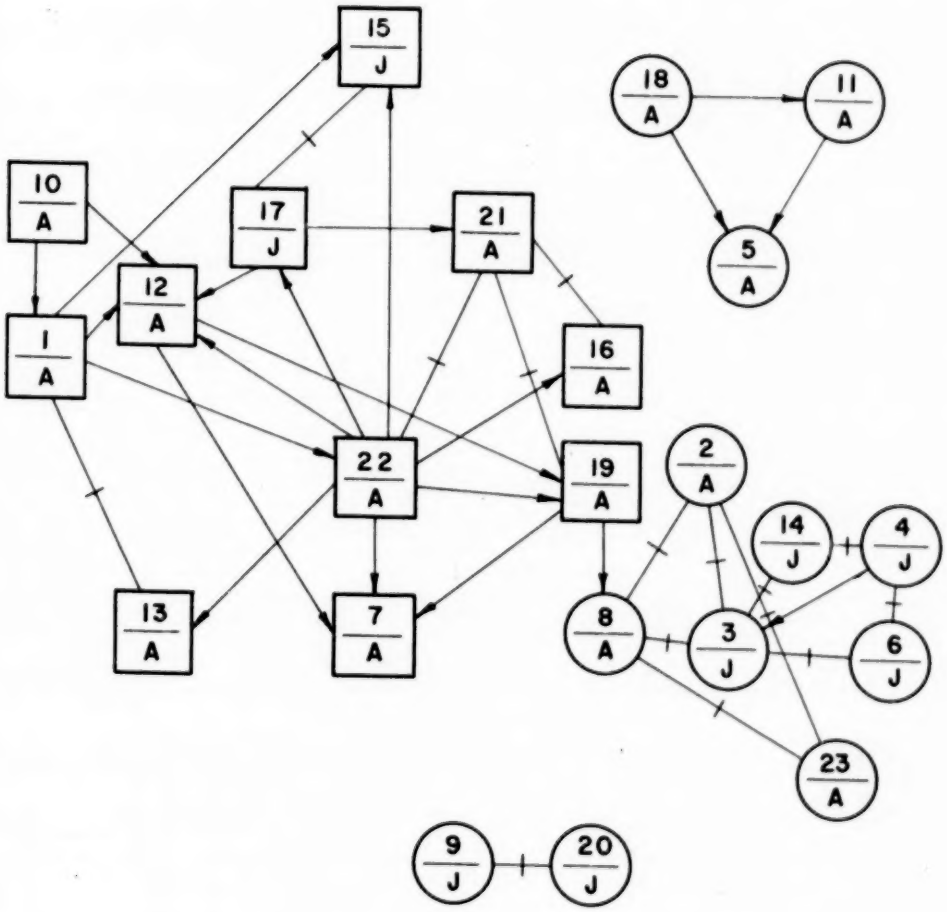


FIG. 4

SCHOOL C, GROUP X

BEGINNING OF EXPERIMENT

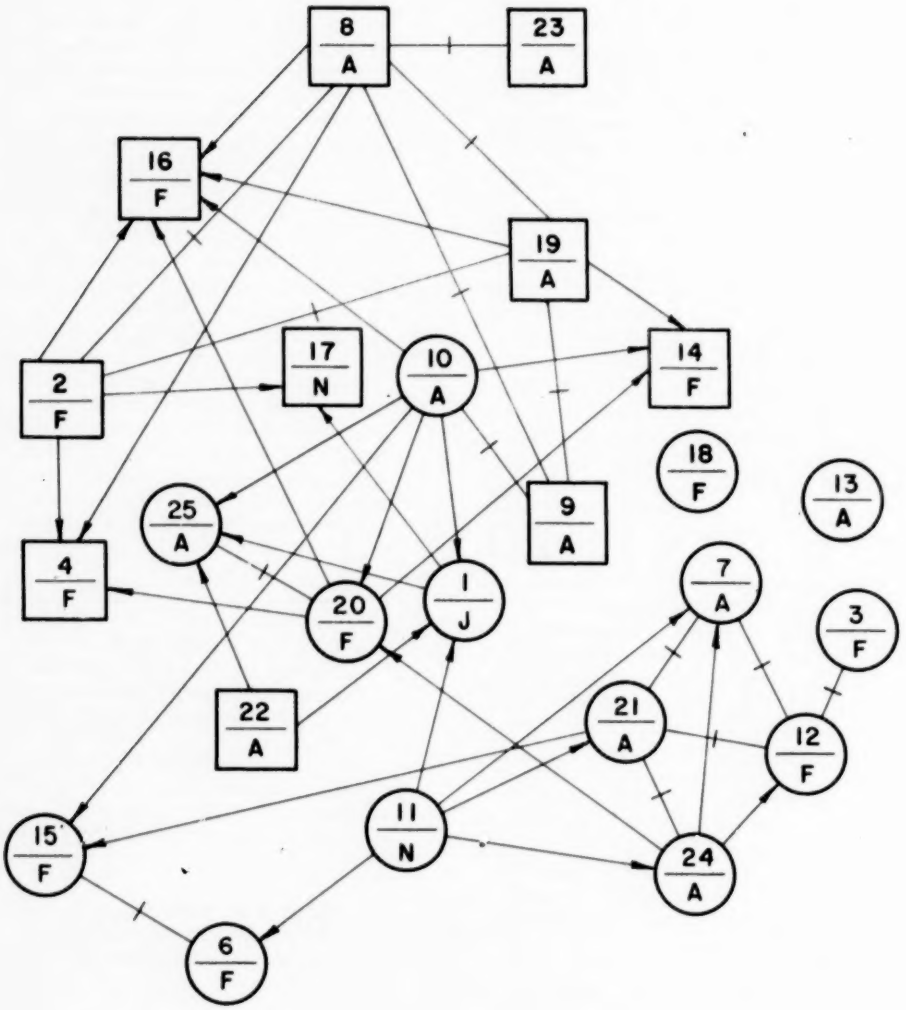


FIG. 5

SCHOOL D, GROUP X

BEGINNING OF EXPERIMENT

TABLE VII

CHANGES IN ACCEPTANCE INDICES FOR EXPERIMENTAL AND CONTROL GROUPS BY SCHOOLS AND SEX

	X Groups			C Groups		
School	Boys	Girls	Total	Boys	Girls	Total
F	+.037	+.041	+.039	+.003	+.008	+.007
G	+.022	+.025	+.024	-.001	-.059	-.032
H	+.052	-.008	+.031	+.012	+.010	+.011
J	+.081	+.123	+.100	+.028	.000	.013
K	+.044	+.043	+.043	+.085	.000	.043
All	+.038	+.076	+.059	+.016	.002	.010

TABLE VIII

CHANGES IN REJECTION INDICES FOR EXPERIMENTAL AND CONTROL GROUPS BY SCHOOLS AND SEX

	X Groups			C Groups		
School	Boys	Girls	Total	Boys	Girls	Total
F	+.008	-.016	-.007	+.055	+.055	+.054
G	-.009	+.036	+.011	+.003	-.007	-.004
H	.000	+.015	+.006	.000	+.007	+.003
J	+.028	+.004	+.018	+.003	+.013	+.011
K	+.005	-.002	+.001	+.016	-.014	+.001
All	+.005	+.004	+.003	+.014	+.008	+.011

by Schools J and F utilized vicarious experience; School K used the method of direct experience.

There was an exhibit of a large number of books, magazines, and pamphlets, which were loaned to schools for the duration of the project. An annotated bibliography[3] was also distributed.

Evaluation instruments were of two kinds: (1) sociometric questions concealed in an interest inventory; (2) the Social Sensitivity Ballots 4, 5, and 11.[4] These latter tests proved too obvious for this age level and the results were discarded.

Analysis

Data gathered in the study was analyzed by cultural and sex groups to reveal changes taking place during the period of experimental teaching. The analysis was limited to the attitudes toward the Jewish American, the Negro American, and the immigrant. In the analysis of the sociometric data the assumption was made that an increase in acceptance of others and a decrease in rejection of others represented progress in intergroup relations, especially if the number of majority-minority and minority-majority acceptances were increased and the corresponding number of rejections decreased. The choices and rejections were tabulated for each child and an index of acceptance and rejection obtained for him by dividing the number of actual choices or rejections by the possible number.

Table VII gives changes in acceptance indices for X and C groups by schools and sex; Table VIII gives changes in rejection indices for the same groups. The change in the X groups as a whole was greater than in C groups. School J showed most change in the X group. This is the school that used the approach of vicarious experience through literature. Least change was made by School G where a factual, intellectual approach was used. School J which showed the greatest increase in acceptance in the X group also showed the greatest increase in rejection. The greatest decrease in rejection was shown by group C in School F; there seems to be no clearcut pattern here. Also, the patterns of acceptance and rejection do not appear to be related to sex.

Tables IX through XII present directional analysis of the pupil's choices and rejections for experimental and control groups by school, sex, cultural, and religious groups at the beginning and end of the experiment. These analyses were made by separate schools since each school differed from the others in cultural makeup. No table was made for School F since all but two of the pupils were of old-American stock and all were Protestant. The indices for these tables were obtained by dividing the actual number of choices or rejections by the possible number. Changes were computed by subtracting indices at the beginning from those at the end; plus values, therefore, indicate increases in acceptance or rejection, minus values decreases in them. Abbreviations for groups were the same as those used earlier in the study; for example a PC acceptance means that a Protestant chose a Catholic as a friend.

Table IX is a directional analysis of pupil acceptances and rejections in School G for experimental and control groups by sex, religious and cultural groups at the beginning and end of the experiment. The X group here contained 18 boys and 15 girls. Of these 28 had non-Jewish, American-born parents, and 5 were Jewish Americans. There were 18 Protestants, 10 Catholics, and five Jews. The control group contained 8 boys and 19 girls; of these 21 were non-Jewish old-stock Americans, 3 were new-stock Americans, and 3 were Jewish Americans; 17 were Protestant, 7 were Catholic, and 3 were Jewish. The greatest increase in acceptance in the X group is the Catholic choice of Jewish friends. Increases in order were: CJ, CC, JJ, BG, JC, BB, AJ, JA, JP, AA, CP, PP; losses were PJ, PC, GG. Decreases in rejection, in order, were: AJ, CP, PJ, and JA; AA, PC, CJ, BG, GG and GB increased in rejection. Increases in acceptance in the C group, in order, were: JC, AJ, GG, FA, JA, JP, and GB; no changes were: CJ, and BG; the losses were: BB, FF, AF, JF, FJ, JJ, PC, CP, PP, PJ, AA, and CC. Decreases in rejection in C group, in order were: PC, PJ, GG, BG, AA, and CP; AJ and GB increased in rejection; others showed no change.

Table X is a directional analysis of pupil acceptances and rejections in School H for experimental and control groups by sex, religious and cultural groups at the beginning and end of the experiment. The X group in this school was made up as follows: boys 9, girls 8; old-stock Americans 14, new-stock Americans 2, Jewish Americans 9, Negro Americans 1; Protestant 7, Catholic 8, Jewish 9. The C group contained the following: boys 6, girls 10; children of non-Jewish American-born parents 15, new-stock Americans 1; Protestant 8, Catholic 6. Religious affiliations did not seem to affect choices and rejections. The one Negro child was very popular. New-stock Americans were accepted by old-stock Americans, and vice-versa. Increases in acceptance in Group X in order were: FF, FN, NF, NA, GG, CP, CC, PP, AA, FA, and PC; no change, AN; decreases, BB, AF, GB, and BC. In this group AF decreased in rejection; PC, BC,

3. Mabel E. Jackman, "Books on Minority Groups for High Schools," Wilson Library Bulletin (May 1949).

4. Published by Ohio State University.

TABLE IX

CHANGES IN DIRECTION OF PUPIL ACCEPTANCE AND REJECTION FOR EXPERIMENTAL AND CONTROL GROUPS IN SCHOOL G BY SEX, RELIGIOUS, AND CULTURAL GROUPS

	X Groups		C Groups	
Groups	Acc.	Rej.	Acc.	Rej.
AA	+.032	+.010	-.015	-.013
AF	.....	.....	-.397	.000
AJ	+.037	-.210	+.030	+.016
FF	.....	.....	-.500	.000
FA	.....	.....	+.017	.000
FJ	.....	.....	-.222	.000
JJ	+.150	.000	-.166	.000
JA	+.036	-.007	+.016	.000
JF	.....	.....	-.222	.000
PP	+.012	.000	-.045	.000
PC	-.050	+.147	-.093	-.057
PJ	-.089	-.011	-.118	-.031
CC	+.167	.000	-.014	.000
CP	+.017	-.026	-.048	-.008
CJ	+.174	+.394	.000	.000
JP	+.033	.000	+.009	.000
JC	+.060	.000	+.047	.000
BB	+.056	.000	-.626	.000
BG	+.064	+.003	.000	-.013
GG	-.009	+.005	+.026	-.015
GB	-.029	+.015	+.004	+.007

TABLE X

CHANGES IN DIRECTION OF PUPIL ACCEPTANCE AND REJECTION FOR EXPERIMENTAL AND CONTROL GROUPS IN SCHOOL H BY SEX, RELIGIOUS AND CULTURAL GROUPS

	X Group		C Group	
Groups	Acc.	Rej.	Acc.	Rej.
AA	+ .045	+.027	+.019	+.033
AF	- .039	-.001	+.017	.000
AN	.000	.000	.....	.....
FF	+1.000	.000	.....	.....
FA	+ .037	.000	-.067	.000
FN	+ .500	.000	.....	.....
NA	+ .072	.000	.....	.....
NF	+ .500	.000	.....	.....
PP	+ .048	.000	+.071	+.018
PC	+ .031	+.034	-.292	+.062
CC	+ .055	.000	-.133	.000
CP	+ .064	+.016	+.004	.000
BG	- .014	+.028	+.100	.000
BB	- .072	+.014	-.033	.000
GG	+ .071	.000	-.078	+.073
GB	- .014	.000	+.200	.000

TABLE XI

CHANGES IN DIRECTION OF PUPIL ACCEPTANCE AND REJECTION FOR EXPERIMENTAL AND CONTROL GROUPS IN SCHOOL H BY SEX, RELIGIOUS AND CULTURAL GROUPS

	X Group		C Group	
Groups	Acc.	Rej.	Acc.	Rej.
AA	+.105	.000	+.136	+.007
AF	+.083	+.042	+.098	.000
AJ	+.250	.000	.....	.....
AN	+.093	.000	+.060	+.014
FF	-.100	.000	.000	.000
FA	-.208	+.042	+.020	+.019
FJ	.000	.000	.....	.....
FN	-.166	.000	+.083	.000
JA	+.084	.000	.....	.....
JF	.000	.000	.....	.....
JN	.000	.000	.....	.....
NN	+.195	.000	.000	.000
NA	+.287	.000	+.074	+.044
NF	+.167	.000	+.166	.000
NJ	+.333	.000	.....	.....
PP	+.077	+.005	-.027	+.041
PC	+.126	+.009	+.083	-.056
PJ	+.143	.000	.....	.....
CC	+.126	.000	+.084	.000
CP	+.126	.000	+.084	.000
CJ	+.375	.000	.....	.....
JP	.000	.000	.....	.....
JC	+.250	.000	.....	.....
BB	+.128	+.006	+.143	+.005
BG	+.154	.000	.000	.000
GG	+.136	+.009	+.288	+.033
GB	+.091	.000	+.050	+.020

TABLE XII

CHANGES IN DIRECTION OF PUPIL ACCEPTANCE AND REJECTION FOR EXPERIMENTAL AND CONTROL GROUPS IN SCHOOL K BY SEX, RELIGIOUS AND CULTURAL GROUPS

	X Group		C Group	
Groups	Acc.	Rej.	Acc.	Rej.
AA	+.010	+.012	+.006	+.001
AF	+.051	.000	+.043	.000
AJ	-.014	.000	.....	.....
FF	-.166	.000	+.031	.000
FA	+.132	.000	.000	.000
FJ	+.250	.000	.....	.....
JA	.000	-.100	.....	.....
JF	.000	.000	.....	.....
PP	.000	+.014	+.071	-.024
PC	+.016	+.008	+.030	.000
PJ	-.222	.000	.....	.....
CC	+.077	.000	+.005	-.003
CP	+.035	-.009	+.038	+.007
CJ	.000	+.071	.....	.....
JP	.000	.000	.....	.....
JC	.000	-.072	.....	.....
BB	+.026	-.006	+.008	.000
BG	+.015	.000	-.005	-.006
GG	+.036	+.028	+.069	.000
GB	+.057	+.007	+.007	.000

AA, CP, and BB increased in rejection; others remained unchanged. In group C, increases in acceptance in order were: GB, BG, PP, AA, AF, and CP; decreases in acceptance were: PC, CC, GG, FA and BB. There were no decreases in rejection in Group C; G, PC, AA, and PP increased in rejection.

Table XI is a similar directional analysis for School J. This school is particularly interesting because it was more heterogeneous from a cultural standpoint than any of the other schools. Also, most of the pupils were of limited intelligence. The economic level is quite low. The X group was made up as follows: boys 13, girls 11; children of non-Jewish American parentage 12, new-stock Americans 2, Jewish Americans 1, Negro Americans 9; Protestant 14, Catholic 8. Membership in C group was as follows: boys 14, girls 10; children of non-Jewish American parentage 17, new-stock Americans 3, Negro Americans 4; Protestant 9, Catholic 4. The considerable number of Negro children were well accepted in School J.

Increases in acceptance in Group X in order were: CJ, NJ, NA, AJ, JC, NN, NF, BG, PJ, GG, BB, CP, CC, PC, AA, AN, GB, JA, AF, PP; no changes were: JP, JN, JF, FJ; decreases were: FA, FN, and FF. There were no decreases in rejection in group X; groups AF, FA, GG, PC, BB and PP increased in rejection. Increases in acceptance in Group C in order were: GG, BB, AA, NF, AF, CC, CP, PC, FN, NA, AN, GB and FA; no changes were: FF, NN, and BG; decreases, PP. The only decrease in rejection in Group C was PC; groups increasing in rejection were: NA, PP, GG, GB, FA, AN, AA and BB.

Table XII is a directional analysis of School K. The X group in this school was made up as follows: boys 13, girls 11; non-Jewish American parentage 19, new-stock Americans 2, Jewish Americans 3; Protestant 7, Catholic 14. The C group had the following membership: boys 17, girls 9; non-Jewish American parentage 23, new-stock Americans 3; Protestant 7, Catholic 19.

Increases in acceptance in Group X in order were: FJ, FA, CC, GB, AF, GB, CP, BB, PC, BG, and AA; decreases were: PJ, FF, and AJ; others were unchanged. Decreases in rejection for the X group were: JC, JA, CP, and BB; increases in rejection were: CJ, GG, PP, AA, PC, and GB; others remained unchanged. Increases in acceptance in Group C were: PP, GG, AF, CP, FF, PC, AA, BB, GB, and CC; BG decreased in acceptance; FA remained unchanged. Decreases in rejection in Group C were: PP, BG, and CC; increases were CP and AA; others remained unchanged.

A study of these tables reveals that in every school a larger number of people in the X group increased their indices of acceptance than in the corresponding C group; as far as decreasing indices of acceptance was concerned the groups showed little difference. Also no group differences were apparent in decreasing indices of rejection, or increasing them. However, indices of rejection showed a tendency to rise; there may be a factor of outgoingness here which shows itself in both acceptance and rejection.

Findings from the Second Year Project

Tentative conclusions may be drawn from the second year project:

1. The instructional approach by vicarious experiences through the study of literature seems more effective than other methods in increasing the amount of acceptance within groups.

2. The experimental teaching seemed, on the whole, to have two effects: (1) it increased the degree of acceptance in the group as a whole; (2) it increased the amount of acceptance cutting across majority-minority group lines.

SUMMARY AND IMPLICATIONS

It seems clear that intergroup attitudes can be improved through special types of teaching. The most promising technique among those tested for changing intergroup attitudes in favorable directions seems to be that of vicarious experience; its superiority over the method of direct experience is probably due to the fact that it is easily manageable and direct experience is usually not; also it is very difficult to make direct experience realistic.

Majority-minority group relations seem to be a part of a larger, overall factor of outgoingness; raising the level of acceptance in one area and seems to affect attitudes in other areas.

The cultural background of the group is a factor in the reaction of the group to experimental techniques for changing intergroup attitudes. New stock Americans and Jewish Americans made larger gains than old-stock Americans.

This study suffered from some handicaps, notably the limitations of present evaluation instruments and the difficulties met in securing favorable real experiences of a significant kind involving members of different cultural groups. Children are influenced by varied factors in their attitudes toward members of other groups and react selectively to educational stimuli according to their sex, cultural backgrounds, age and intelligence. Progress lies in developing more valid

instruments of evaluation and using them to test varied techniques, among more heterogeneous groups, and in more realistic situations. It has been pointed out that the handicaps under which one works are especially great in this field. There is a corresponding need for caution in interpreting results. The best that can be hoped for is that some useful clues have been found for the guidance of teachers and that the participants in the project have developed more social sensitivity.

THE RELATIONSHIP BETWEEN THE SOCIAL STRUCTURE OF THE CLASSROOM AND THE ACADEMIC SUCCESS OF THE PUPILS

MARGARET M. BUSWELL*
Iowa State Teachers College
Cedar Falls, Iowa

Statement of the Problem

THE PURPOSE of the present investigation is to determine whether or not those children who are accepted by their peers differ in certain achievements from those who are rejected.

A sociometric study of almost any group will show that some members are consistently rejected while others are given most of the attention, positions of leadership, and other responsibilities. To be always on the outskirts of a group is not only harmful to the individual, but limits the potential help that this individual might give to the group if he were an accepted member of it. Present theories in regard to group dynamics indicate that it is not necessary for groups to be so constructed. Under proper leadership, all members of the group should become participating members. If a group is so constituted as to include some members who largely dominate the scene, and others who seldom enter in except as on-lookers, it is important to know which people are in these capacities, and what they are like in other respects. Only after the leader has identified those who are playing the various roles in the group, can he work toward effecting a balance.

According to modern philosophies of education, the good teacher does more than merely dispense subject matter to pupils. One of the things she presumably does is to help children learn to live and work and play cooperatively. She attempts to help each individual develop his capacities and to take advantage of his particular talents. She thus develops in each child something, however small, which he can contribute to the group. She must also help him find the opportunity to make this contribution. Some children find something to give to the others without too much specific help from the teacher. But it is very likely that every teacher will have some isolated individuals in her class. It is important for her to know why these children are isolated and why they are not able to contribute to the group, in order that she may help improve their social relationships in the classroom. To do this she also needs to know the basis of the smaller classroom groups.

Most studies of the social acceptability of elementary school children seem to have been sociometric in nature. Research by Moreno has shown that more accurate information about the acceptability of children by their peers may be obtained from the children themselves than from the judgment of their teachers. In checking the accuracy of teachers' judgments regarding the most and least popular members of the various classroom groups, Moreno found a constantly decreasing figure, from that of being 62.5% accurate in the kindergarten down to being only 25% accurate in the seventh grade, with an increase to 40% in the eighth grade (11). If teachers, knowing pupils as well as they do, are unable to learn from observation how the group is structured socially, it is evident that some more accurate measure is necessary.

Several studies have reported results which indicate the degree of stability of sociometric measures. There is a fairly wide variation in the results obtained. At the one extreme are the results of Stacker who found at the fifth grade level a correlation of .87 between a sociometric retest and one given five months earlier (13). At the other extreme, Criswell finds a fluctuation of from 20% to 50% in the choice of ones' best friends over a six-week period in grades 1 to 8 (3). However, even with this great degree of fluctuation, no significant changes in the general structure of the classroom were found. 1

The majority of these studies have been in the

* The writer wishes to express sincere appreciation to Guy L. Bond, University of Minnesota, for his guidance and advice.

1. For a discussion of the contribution of several investigators toward sociometric measurement in general, including reliability, validity, and methods of interpreting the results, see Ph.D thesis of the writer, University of Minnesota Library.

general area of personality factors with achievement and intelligence playing minor roles. As it is hardly feasible to tackle all phases of the problem at once, in the present study an attempt was made to focus attention on the aspect of achievement. A few other investigators have also taken this approach. McLendon found a direct relationship between achievement as measured by the Stanford Achievement Test given in the fifth and sixth grades, and social acceptability when she compared the extreme cases (9). In the intermediate grades she gave the California Test of Mental Maturity and again merely through observing the extreme cases, she found intelligence to be related to acceptability. Mitchell found a relationship between enjoyment of reading and social acceptability in a sixth grade class in a New York community (10). Nora Loeb seems even more convinced of the relationship between the acceptability of the pupil and his achievement (7). She implies that the achievement is a cause of the acceptability, for she suggests the hypothesis that "The skills that the culture itself regards as important in order for the individual to participate in it effectively, are also regarded by the children themselves as important for effective participating with one another." (7, p. 63) Her other main conclusion is based on results that are further from general concensus—that there is such a slight relationship between intelligence and acceptability that the schools can really be expected to make changes in the social acceptability of the pupils. Bonney, in a none too critical study, compared pairs of mutual friends with unreciprocated pairs to see if the former were more nearly alike in any of several criteria (2). So far as academic achievement is concerned, in all grades the mutual pairs were found to be more alike than the others, although the differences were not significant. In another journal Bonney reports further results of his study wherein he correlated social acceptability with reading ability and with I. Q., (1). For the former, he found coefficients varying from .25 to .36, and for the latter, from .31 to .34 for the second, third, and fourth grades. No tests of significance were reported.

Young sees the other side of the picture after giving the Ohio Social Acceptance Scale and many other measures to a class of seventh graders. He says, "As might be expected, the sociometric array of seven criteria correlated negatively with intelligence quotients and only slightly with achievement test grade placements. Expressed in another way, this study bore out the findings frequently reported by students of the social psychology of children that social status is not associated to any extent with a child's intelligence or his school work."(14) He does not name the students who have made this discovery, but it would indicate a possible bias in the findings of both educators and sociologists when they come to such opposing conclusions.

In the hope of throwing light on controversies such as this, the present investigation was undertaken. With the general aim of looking at the social acceptability of children with a focus on their achievement, the social structure of two different age groups of school children was studied by means of the sociometric technique in order to test the following null hypothesis:

> There is no relationship between the social structure of a classroom group and the achievement in some of the basic elementary school subjects of the members of the class.

The general problem was to search for a relationship between achievement and social acceptability. A secondary problem, upon the solution of which the primary problem was dependent, was to find a good measure of social acceptability. Present scales and techniques are still not very good, and are in need of much refinement. Therefore, there was an attempt to check the validity of these measures and to find one that could be considered an acceptable measure for the present study.

During the study of this problem there was an attempt to answer several questions. First, do the children of the most accepted group and those of the least accepted group differ in the achievements to be measured? If so, can this difference be accounted for by the intelligence or by the socio-economic status of the group, or is the difference significant even when these factors are held constant? Second, if there is a relationship between social acceptability and achievement, is it stronger at the end of the school year when academic success is more prominent in every-day life than after a summer vacation when children tend to have developed different bases for choosing their friends? Third, do children tend to join together in clusters on the basis of any of the factors tested? That is, do children prefer friends who are more like themselves in social acceptability, in academic ability, in intelligence, or in socio-economic status? And fourth, will the relationship, if any exists, be stronger in the sixth grade than in the kindergarten?

This study is first a descriptive study, describing as nearly as can be measured the social relationships which exist in the classroom. In addition, it is an interpretive study, seeking to discover some facts about the relationship between the degree to which a child achieves in his school work and the degree to which he is accepted by his peers—which is, indeed, also a measure of achievement.

Design of the Investigation

The present study involves an analysis of social acceptability of children at two different grade levels. One group of children was studied in kindergarten in the spring of 1949, and again in the following fall when they were in the first grade. This group will be referred to as the kindergarten-first grade group, or as the lower grades. The second group was studied in the fifth grade in the spring of 1949 and again in the following fall in the sixth grade. These pupils will be referred to as the fifth-sixth grade group, or the upper grades. By the use of analysis of variance and covariance, the socially most acceptable members of each group and the socially least acceptable were compared on several factors in order to determine what may be associated with social acceptability.

Selection and Description of the Sample

It was decided to use the city of St. Paul, Minnesota, as the general population from which to draw a sample. The results of a pilot study indicated that a sample of between 250 and 300 pupils would give a stable population upon which to base conclusions. Therefore, since it was inevitable that a certain number of cases would be lost before the follow-up in the fall, enough fifth grade classes in St. Paul were selected to give a population of somewhat over 300. The schools to be studied were chosen at random by the use of the Kendall and Babbington Smith Tables of Random Numbers (6, p. 194). A total of eleven fifth grade classrooms in eight schools were used. This made up the total fifth grade population in each of the schools. The kindergarten population was composed of all the kindergarteners in the eight schools selected.

The number of cases in the fifth grade in the spring was 358. Thirty-seven of these children did not return to school in the fall. Therefore the upper grade population studied consisted of 321 cases, 145 boys and 176 girls. Since it was found that the mean score in intelligence and in each of the achievements measured did not differ for the 37 cases from those for the 321, it was assumed that the loss of these cases did not bias the sample.

In the kindergartens in the spring there were many more cases than in the fifth grades. The kindergartens in two of the schools had to be dropped from the study because of incomplete data, leaving in the fall a total of 286 children, 139 boys and 147 girls, of the younger age group. A comparison of the mean reading readiness scores (used at this level as the estimate of future achievement) for the schools dropped and the schools retained again showed no difference and therefore presumably an unbiased sample still remained.

Instruments Used

Upper Grades

Intelligence. —As a measure of intelligence in the upper grade group, the Revised Stanford Binet Test was used. The superiority of this test over group tests as a method of estimating intelligence is undisputed. The validity of the instrument in this particular case depends upon the accuracy of the student examiners who administered the tests. On another occasion the results obtained by a similar class of student testers were compared with those of experienced examiners and found to agree closely (8). This indicates that it is reasonable to assume the I. Q. 's obtained in this study to be adequate estimates of the true intelligence quotients of the pupils.

Achievement. —The Iowa Every Pupil Tests of Basic Skills[2] were selected as the means of measuring the achievement of the pupils, since these were considered by the investigator to be the best tests of general understandings and skills. The norms were established in the Middle West and should therefore be applicable to these pupils. In addition, reliability and validity are considered to be adequate. The sections of the battery which were used in the present investigation were those testing reading, arithmetic, and basic study skills.

Socio-Economic Status. —The Sims Score Card for Determining Socio-Economic Status[3] was used to give a general indication of the type of home background from which the pupils came. Sims indicates that all scores derived from the inventory are relative and are best compared with other scores in the same community rather than with scores for other communities. So long as St. Paul children are being compared with other St. Paul children, the results are adequate for the present purpose.

Acceptability. —The most questionable instruments used in the study were those for determining the acceptance of a child by the other members of the group. These measures, besides being the least adequate, were the most vital to the success of the study as a whole, for it was on the

2. Constructed by E. F. Lindquist and others, State University of Iowa. Distributed by Houghton Mifflin & Co., Boston, 1949.

3. Constructed by V. M. Sims, University of Alabama. Distributed by the Public School Publishing Co., Bloomington, Illinois, 1927.

basis of degree of social acceptability that the various comparisons were made. As the field of social measurement is a comparatively new one, the measures need considerable refinement. The measures chosen for this study seem to be as adequate as any for the use to which they were put.

The Ohio Social Acceptance Scale[4], which was used in this study, is a device whereby each individual in the class rates each other individual on a six-point scale ranging from a rating of "1", entitled "My very, very best friends" to a rating of "6" entitled "Dislike them." Louis Raths, in an article on the validity of this scale, states that validity can only be established over a period of time, but so far the validity of the scale has not been disproved (12). It does have internal consistency due to the fact that it was constructed by teachers and pupils working together. It is in the interpretation of the ratings, after the pupils have made them, that the instrument gives the least constructive help. According to the manual of directions, arbitrary weights are to be assigned to the various categories, a weighting of 15 being given to "My very, very best friends," 10 to "My other friends," etc., down to zero for "Dislike them." As there seemed to be no way in which the use of these arbitrary weights might be justified, other methods of determining acceptability scores from this instrument were attempted. They are described below, pages 41, 43.

Two other measures of degree of acceptability were obtained, and although they were not used in the final analysis, they were used as a rough means of validating the Ohio scale. Both of these measures were questionnaires constructed by the investigator. The first was a measure of friendship, and asked that each individual write down, in order of preference, the names of the three people in the classroom with whom he most enjoyed being, both in and out of school. The second was an attempt to distinguish between friendship and recognition of leadership. In the spring this consisted of questions such as "If your class were planning a party, who do you think would make the best chairman?" In the fall the questions were more general, e.g., "Who do you think is the most outstanding member of your class?" The advantage of a general question, such as that used in the friendship questionnaire and in the leadership questionnaire in the fall, is that it would take many specific questions to give a valid over-all picture.

Both on the questionnaires and on the Ohio Social Acceptance Scale, the identity of the pupils was concealed so far as the pupils themselves were concerned. That is, in order to obtain truthful appraisals of their classmates, they were not asked to sign their names. However, since for research purposes it was necessary to know which paper belonged to each pupil, the papers were coded and distributed in order, so that the names could be put on each one later.

These measures, then, of intelligence, achievement, socio-economic status, and acceptability, supplied the data around which the analyses at the upper grade level were designed.

Lower Grades

Intelligence. —Since the Detroit Beginning First-Grade Intelligence Tests[5] are given by every first grade teacher in St. Paul each fall, it was decided to use the results of these as an estimate of the intelligence of the younger group of children in the study. This is a paper-and-pencil test, and does not have the advantage of the Stanford Binet of being an individual measure. Yet it is given to small enough groups of children to allow for individual attention. The test is non-verbal so far as reading is concerned, but the children must follow the verbal directions of the teacher. Although adequate norms seem to be given, based on a large urban population as in the present study, the raw scores rather than mental ages were used, since in some cases the norms did not go low enough.

Readiness. —Since no measure of achievement can be made on pupils entering first grade, a reading readiness test was given as the best single estimate of the future success of the individuals. The Gates Reading Readiness Test[6] was used as the investigator considered it as good a means for predicting success as any of the readiness tests on the market.

Acceptability. —Both at the time when the children were in kindergarten and when they were in the first grade, their acceptability was determined by individual interview. They were asked, "Of all the boys and girls in this room, who do you like best of all?" When that choice had been indicated, the request was made, "Now tell me the names of two other children in your room that

---

4. Prepared under the direction of the Ohio Scholarship Tests and the Division of Elementary Supervision, State Department of Education, Columbus, Ohio, 1946.

5. Constructed by Anna M. Engle and Harry J. Baker. Distributed by World Book Co., Yonkers-on-Hudson, New York, revised, 1937.

6. Constructed by Arthur I. Gates. Distributed by Bureau of Publications, Teachers College, Columbia University, New York, revised 1942.

you like very much." In the final analysis all three choices were given equal weighting.

Dates and Administration of Tests

The spring testing at both the kindergarten and fifth grade levels was done in May and early June, 1949. The follow-up testing was done during the first six weeks of school in the fall of 1949. In the fall the sociometric tests were the last ones to be given in order that, particularly at the lower grade level, the children have an opportunity to know each other better. Figure 1 indicates the general schedule for collecting the data. All testing, except in the case of the Detroit tests which were given by the first grade teachers, was carried out by the investigator assisted by University students trained in testing procedures.

Selection of Groups for Analysis

The most important step in the analysis of the data was determining whether or not a child should be placed in the Accepted or in the Rejected Group. As more data were collected on the upper age group in this respect, this level will be considered first.

Upper Grades. —Here there were several possible means of analysis. One way would involve looking at the first, second, and third choices made in response to the question, "Who in this room do you like best to do things with in and out of school?" It would be possible to look at the first choices only, or to look at the total of all three choices, or to make a set of weightings for each of the three choices. It was found that totaling all three choices gave approximately the same results as did using the first choices alone. However, using only the first choices produced more ties, making decisions difficult regarding which pupils to include in the Accepted and Rejected Groups.

The leadership data were used in correlation technique to investigate the relationship between this factor and friendship. Had the correlation approached unity, it would have appeared that the children were recording as "friends" really those people whom they admired as leaders. However, as the Pearson correlation coefficient was .639 it is obvious that a distinction was made. Thus not leadership, but friendship, is what is being measured. With this question answered, the leadership data were no longer used for the analysis.

In addition to the several possible means of analyzing the data on the sociometric questionnaires, the Ohio Social Acceptance Scale should in some manner be analyzed. As was stated above, there seems to be no justification for using arbitrary weightings. Another question arising out of the use of all six degrees on this scale is that of the human variable. Can the fifth and sixth graders accurately distinguish between the others in the room in six varying degrees? It was decided that a more valid measure would be obtained by using only the extremes of the scale, considering as "Accepted" those most often chosen as "My very, very best friend", and as "Rejected" those with the most votes in the "Dislike them" column. Rather than simply taking the total number in each of these two categories, two adjustments were made. The first was in the case of children who gave a rating of "6" (Dislike them) to no one. In the minds of many individuals, as well as in some classes in general, it is not considered 'nice' to say that one does not like a person. For the people who feel this way, the most extreme form of rejection was expressed by the "5" category, stated as "Don't care for them". Therefore, if no sixes were given, the fives were counted. However, when neither fives nor sixes were given it was not deemed just to count the fours or the threes, as it is possible that a person might dislike no one in his class. In general, it appeared that those not using the "5" and "6" categories were the best-liked people, and it would seem reasonable to believe that they did not really dislike anyone. A similar adjustment was not made at the positive end of the scale, as raters here have not been found to avoid this extreme to the extent that they avoid the negative.

A second adjustment was made since no restriction was put on the number of names that might be placed in each of the six categories and some pupils were much more generous with their ratings of "1" or "6" than were others. There were boys, for instance, who automatically gave a "6" to every girl in the class. Getting a "6" from such a boy would imply the same degree of rejection as would receiving a "6" from someone who gave only one "6" to the entire group. Therefore, for each person, there was calculated the value that his "1" and his "6" had when given to a boy and when given to a girl. This was done by assuming that the ratings should be distributed normally and calculating the percent of each rating that should be expected. By the use of the normal table, these percents were then converted into weightings, so that when few of either value were given, the rating would be weighted heavily, while if many were given, they would add little to the total score. This method of normalizing is described by Holzinger (4, pp. 221-224). This process of obtaining separate weightings for the ratings given to boys and to girls made it possible to combine the sexes for further analysis. When these weights had been calculated for choices as given by each individual, the total score received by each was computed. The Accepted Group was composed of those in the upper 27% as based on the ratings of "1" and

Kindergarten-Grade 1		
	Acceptability (Interview)	Acceptability (Interview)
		Intelligence (Detroit)
		Reading Readiness (Gates)
Grades 5 - 6		
	Acceptability (Ohio and Questionnaires)	Acceptability (Ohio and Questionnaires)
	Achievement (Iowa)	Socio-Economic Status (Sims)
	Inielligence (Binet)*	

*In three of the eleven classes, the Binet Tests were given in the following fall. As I. Q. rather than M. A. was used in the calculations, this should make no difference.

Figure 1

Time of Test Administration

the Rejected Group, of those in the upper 27% as based on the ratings of "6". This introduced one interesting factor not encountered when the two groups to be compared are taken from the opposite extremes of the same continuum. Here it was possible for one individual to be in the most accepted group and also to be in the most rejected. After a moment's thought it will seem that this is understandable. We have all known individuals who are extreme personalities, who are idolized or despised, and about whom no one feels neutral. Therefore, these individuals, five in number in the spring and six in the fall, were included in both groups. Altogether, there were 86 pupils in the Accepted Group and 86 pupils in the Rejected Group both spring and fall.

When the groups had been selected on this basis, the investigator then returned to the sociometric questionnaires to see who would have been in the extreme groups if only total number of times chosen had been the criterion. There was a surprising degree of similarity in the two lists. "Why then," one might ask, "should such a lengthy normalizing process be used, when counting total number of first, second, and third choices would give substantially the same results?" The chief advantage is in having a definite basis for breaking ties. In choosing the 27% in a class, say, of 33 pupils where nine would be needed for each group, there might be seven who had definitely received more choices than any of the others, but five more might be tied for the last two places on the list. In many cases these first seven would be the same as determined by either method, but the weighting system is more discriminating and therefore these ties do not occur. This makes the choosing of the groups less arbitrary.

Lower Grades.—Checking the acceptability data by two methods, Ohio Social Acceptance Scale and Sociometric Questionnaire, has two advantages. As stated above, the close agreement between the two measures lends an indication of validity to the data. In addition, at the kindergarten-first grade level it was not possible to get data by means of the Ohio Scale, and it is good to know that using the data obtained by totaling first, second, and third choices gives substantially the same results. Even when it is decided that the total number of choices received can justifiably be used as indicating acceptability at this age level, the problem of breaking ties is still encountered. Therefore a definite criterion was set upon which to base the inclusion or exclusion of cases. After the groups had thus been selected there were 76 children in the Accepted Group in the spring and 80 in the Accepted Group in the fall. At this younger age level it did not seem advisable to ask the children for negative information about their classmates, so instead of a Rejected Group at this level, the group will be called Ignored. There were 81 children in this group in the spring, and 77 in the fall.

With the groups chosen (an Accepted and a Rejected Group for the fifth grade in the spring and for the sixth grade in the fall, and an Accepted and Ignored Group for the kindergarten in the spring and for the first grade in the fall) it was then possible to continue the analysis.

Summary of the Design of the Investigation

The present study of the relationship between social acceptability and achievement began with the selection through a process of randomization, of a group of 321 fifth graders and 286 kindergarteners who were to be studied. To the older group was given a battery of achievement tests, an intelligence test, a questionnaire to determine socio-economic status, and three measures of social acceptability. The younger children were given readiness tests and intelligence tests, and were interviewed individually regarding their choice of friends.

From the sociometric data, two groups of children were selected at each level, one group that was well-liked by the others and one group that was not. The children in these extreme groups of social acceptability were studied both before and after a summer vacation.

After the assumptions basic to the statistical procedures had been satisfied, these two groups of children at each level were compared by means of the technique of analysis of variance and covariance to see whether or not, and how, they differed.

Testing of Basic Assumptions

Before the actual statistical analysis was undertaken, certain assumptions were tested. Tests of homogeneity and normality were made for the various factors. These assumptions are discussed in the order in which they were encountered and satisfied during the analysis. The reader not interested in the testing of these assumptions may omit this section. He may proceed directly to the section entitled "Analysis of the Results."

Pooling the Schools

The data for this investigation were obtained from eight schools in St. Paul. In order that the results from all these schools might be considered as one group rather than as eight separate groups, it was shown that the populations of these schools were homogeneous. That is, before the data were pooled it was shown that the schools were not significantly different from each other in either variability or mean in each of the three outcome variables, reading, arithmetic, and work-

study skills. The L-Test, as devised by Welch (5, p. 83), was used in determining the significance of the differences among the variances of the measures; and the F-Test (5, p. 214) was used in determining the significance of the differences between the means of the eight schools for each of the three achievements.

At both the upper and lower grade levels all measures of achievement and intelligence were found to be homogeneous in variance among the classes in the eight schools. Homogeneity of means was also established on all outcome variables at both levels. In socio-economic status for the upper grades and in intelligence at both grade levels the schools were not found to be homogeneous in mean score. Since in a representative sample of a large city one would expect these measures to differ between neighborhoods, it was decided that, if the total data appeared to be normally distributed, it would be assumed that the schools were from the same homogeneous population in regard to these factors. The existence of normality was determined by the method of probit analysis.

Since it had been established that the eight schools were sufficiently similar that they might be considered to belong to one homogeneous population, all data were pooled for further analysis.

Testing of Hypotheses Basic to the Analysis of Covariance

Upper Grades. —The first step in the comparison of the Accepted and Rejected Groups was that of determining whether or not these two groups were homogeneous in variance, for until this was determined it was not known which test was appropriate for comparing the means of the two groups.

By using the F-Test, the variability of the Accepted and Rejected Groups was compared on each of the three achievements: arithmetic, reading, and study skills. The results of this analysis may be seen in Table I. As seen in the table, the hypothesis in each case was accepted. That is, on each achievement, both spring and fall, the Accepted Group and the Rejected Group were similar in variability. Therefore it was permissible to proceed with the analysis of variance in order to determine whether or not the means of the two groups differ.

During the process of the analysis of covariance it was necessary to test another assumption. The analysis of covariance is a process whereby factors which are presumed to have an effect on the outcome variable may be statistically held constant during the analysis in order to determine the relative effects of the various factors which seem to be involved. At the fifth and sixth grade levels the factors presumed by the investigator to have a possible effect on the social acceptability of the children (in addition to the achievement factors which were being studied), were the factors of intelligence and socio-economic status. Therefore, the technique of covariance was used to control these factors so that their effects might be studied independently. Hence, when the stage of the covariance analysis was reached in which these two factors were controlled, the assumption was made that, even with these factors held constant, the variabilities of the Accepted Group and the Rejected Group were not statistically different. Actually what was being tested in regard to this assumption was the homogeneity of regression of the dependent factors (the achievements) on intelligence and socio-economic status. Each of the two factors was controlled separately, and both were controlled simultaneously. The results of this analysis are found in Table II. In reading and study skills all hypotheses were accepted. In arithmetic at the sixth grade level the observed F-value was between the .01 and .05 values and therefore the rejection of the hypothesis was doubtful. However, as the .01 level had been set as the critical level, the groups were considered as homogeneous. Since the hypotheses with respect to the upper grades were therefore accepted, all the assumptions basic to the analysis of covariance were satisfied.

Lower Grades. —The statistical procedures just described for testing the assumptions basic to the technique of covariance were repeated, using data for the kindergarten-first grade group. Since at this level one readiness score served as the measure of "achievement", the procedure needed to be performed only once on the spring groups and once on the fall groups, rather than three times for each year as in the case of the older group. Table III summarizes the tests of homogeneity of variance between the Accepted and Ignored Groups.

At this lower level there were two factors, in addition to the factor of readiness, which were considered to exert a possible influence on the social acceptability of the child. These were intelligence and chronological age. By the tests of homogeneity of regression, as explained above for the upper grades, the final assumptions basic to the analysis of covariance for the lower grades were satisfied. Table IV gives a summary of the results of these tests. Again it was found that all of the hypotheses were accepted at the .01 level. Therefore it was possible to continue the analysis.

Analysis of the Results

Comparison of the Accepted with the Rejected Group by the Process of Analysis of Variance and Covariance

In the upper grades, for each of the three achievements (reading, arithmetic, and study

TESTS I

SUMMARY OF TESTS OF HOMOGENEITY OF VARIANCE IN VARIOUS FACTORS FOR THE ACCEPTED AND REJECTED GROUPS IN THE UPPER GRADES*

Measurement	F_0	Hypothesis
Spring		
Reading	1.00	Accepted
Arithmetic	1.23	Accepted
Study Skills	1.04	Accepted
Fall		
Reading	1.00	Accepted
Arithmetic	1.39	Accepted
Study Skills	1.11	Accepted

$F_{01} = 2.58$

*For complete tables, see unpublished Ph.D. thesis of the writer, University of Minnesota Library.

TABLE II

SUMMARY OF TESTS OF HOMOGENEITY OF REGRESSION OF THE ACCEPTED AND REJECTED GROUPS IN THE UPPER GRADES

Measurement	Regression of Reading F_0 Hypothesis	Regression of Arithmetic F_0 Hypothesis	Regression of Study Skills F_0 Hypothesis
Spring			
Intelligence	1.05 Accepted	1.26 Accepted	1.32 Accepted
Socio-Economic	1.02 Accepted	1.24 Accepted	1.08 Accepted
Both of the Above	1.06 Accepted	1.28 Accepted	1.38 Accepted
Fall			
Intelligence	1.02 Accepted	1.47 Doubtful	1.34 Accepted
Socio-Economic Status	1.06 Accepted	1.51 Doubtful	1.11 Accepted
Both of the Above	1.00 Accepted	1.52 Doubtful	1.35 Accepted

TABLE III

SUMMARY OF TESTS OF HOMOGENEITY OF VARIANCE IN READING READINESS OF THE ACCEPTED AND IGNORED GROUPS IN THE LOWER GRADES

	F_0	Hypothesis
Spring	1.36	Accepted
Fall	1.61	Doubtful

TABLE IV

SUMMARY OF TESTS OF HOMOGENEITY OF REGRESSION OF THE ACCEPTED AND IGNORED GROUPS IN THE LOWER GRADES

	Regression of Reading Readiness	
Measurement	F_0	Hypothesis
Spring		
Intelligence	1.09	Accepted
Chronological Age	1.37	Accepted
Both of the Above	1.09	Accepted
Fall		
Intelligence	1.23	Accepted
Chronological Age	1.60	Doubtful
Both of the Above	1.23	Accepted

TABLE V

TEST OF THE DIFFERENCE BETWEEN THE MEANS IN READING SCORE OF THE ACCEPTED GROUP AND THE REJECTED GROUP IN THE FIFTH GRADE

Source of Variation	D. F.	Sum of Squares	Mean Square	F	Hypothesis
Between Groups	1	3,709.698	3,709.698	14.147	Rejected
Within Groups	166	43,528.820	262.222		
Total	167	47,238.518			

skills) the mean scores were calculated for the Accepted Group and for the Rejected Group. The significance of the differences between the means was then tested. These tests were followed by similar tests to determine whether or not, with the factors of intelligence and socio-economic status held constant, there would be a difference between these means. Two final tests of covariance were run, controlling each of these factors (I. Q. and S. E. S.) separately, in order to determine the effect of each on the mean achievements of the two groups. Since direct comparisons seem to be the most meaningful, Table V indicates how the analysis has been carried out and Table VI summarizes the results of the tests. A study of Table VI indicates several facts which it would be well to list before attempting interpretation.

1. At all levels, with no factors controlled, the two extreme groups in acceptability were significantly different in mean achievement, always in favor of the Accepted Group. One reservation to this statement should be made in regard to the arithmetic score, where the difference was in the region of doubt. However, the F-value approached the 1% level. Were it to reach this level, it would be concluded that the Accepted Group was unlike the Rejected Group in arithmetic, as in the other achievements.

2. When intelligence and socio-economic status were controlled, these differences between the means in the various achievements disappeared.

3. When intelligence alone was controlled, there was still no difference between the mean achievement of the two groups.

4. When socio-economic status alone was controlled there was a difference, just as there was when no factors had been controlled, except in the case of the arithmetic score in the sixth grade, which had remained in the area of doubt in the first test. This arithmetic test is the one test on which the control of socio-economic status was found to exert an influence.

The fact that there was a difference between the Accepted and the Rejected Groups in most factors of achievement is not as difficult to understand as the fact that, in the fall in arithmetic, the relationship was so slight. Even the factor of socio-economic status, which was not enough to bring the two groups together at any other time, when controlled, made the two groups alike in arithmetic achievement in the sixth grade. Is this because arithmetic, as probably taught in many of the classes studied, is a tool which is used for only one period a day, whereas reading and study skills enter into so many activities that those children poor in these abilities will be more evident to the others? Since arithmetic ability is positively related to achievement in the spring, could it be that during the summer vacation the pupils found little apparent use for it, so those who did not excel had no handicap, while those children who liked to read found opportunity for this pastime and were observed by the others in this activity? The causes for this circumstance can only be hypothesized. This investigation does not attempt to produce answers in regard to causality. However, it is interesting to speculate as to why certain relationships have come about.

With the exception of this arithmetic factor, which seems out of line with the other results, it was rather definitely shown that achievement as such is related to social acceptability, that it is the intellectual factor associated with this achievement which is the basic component in the relationship, and that socio-economic status as such has little relationship to social acceptability.

For the lower grade group the data have been summarized in a fashion similar to that of the data for the upper grades. The basic relationships are summarized in Table VII. Two general remarks should be made about the facts shown in this table:

1. In the first grade the acceptance and rejection of hypotheses follow the same pattern as in the upper grades. That is, with no factors controlled, the Accepted Group had a significantly higher mean score in reading readiness than the Isolated Group; with both mental ability and chronological age controlled, the differences were no longer seen to exist; and of these two factors, it was the intelligence which alone could bring about the acceptance of the hypothesis of no relationship.

2. The only time in the entire study when no relationship was found between those who were acceptable and those who were achieving was at the kindergarten level. It must be remembered that data about acceptability of the kindergarteners was secured from them in the spring, and the reading readiness test, by which their "achievement" was measured, was given in the following fall. Thus it was found that the children who were socially most accepted in kindergarten, and those who were socially least accepted were not significantly different in the following fall in reading readiness as measured by the Gates Reading Readiness Test.

The interpretation of these two opposing conditions can only be a reiteration of the facts; the children who were socially most acceptable in kindergarten were not necessarily the ones who were the most successful in a reading readiness test the following fall; the children who were socially most acceptable in the first grade, were, in general, the ones who were successful in a reading readiness test. Whether this change came first in acceptability and then in success in school, whether the success in school preced-

TABLE VI

SUMMARY OF TESTS OF HOMOGENEITY OF MEANS BETWEEN THE ACCEPTED AND THE REJECTED GROUPS ON THE VARIOUS FACTORS STUDIED IN THE UPPER GRADES

		Factors Controlled											
		None			Intelligence and S. E. S.			Intelligence			Socio-Economic Status		
Measurement	Mean	D. F.	F_o	H	D. F.	F_o	H	D. F.	F_o	H	D. F.	F_o	H
Grade 5													
Reading													
Accepted	66.95	1	14.147	Rej.	1	1.063	Acc.	1	1.179	Acc.	1	12.750	Rej.
Rejected	57.55	166			164			165			165		
Arithmetic													
Accepted	58.11	1	9.699	Rej.	1	1.554	Acc.	1	1.486	Acc.	1	7.663	Rej.
Rejected	54.77	166			164			165			165		
Study Skills													
Accepted	58.65	1	13.820	Rej.	1	1.462	Acc.	1	1.391	Acc.	1	11.871	Rej.
Rejected	51.82	164			162			163			163		
Grade 6													
Reading													
Accepted	64.80	1	10.784	Rej.	1	.....	Acc.	1	.....	Acc.	1	7.423	Rej.
Rejected	56.58	166			164			165			165		
Arithmetic													
Accepted	57.41	1	6.527	Doubt	1	.....	Acc.	1	.....	Acc.	1	3.808	Acc.
Rejected	54.61	165			163			164			164		
Study Skills													
Accepted	58.24	1	15.022	Rej.	1	1.747	Acc.	1	1.769	Acc.	1	10.713	Rej.
Rejected	51.37	165			163			164			164		

	.05	.01
$n_1 = 1$)		
	3.90	6.79
$n_2 = 165$)		

TABLE VII

SUMMARY OF TESTS OF HOMOGENEITY OF MEANS BETWEEN THE ACCEPTED AND THE ISOLATED GROUPS ON READING READINESS IN THE LOWER GRADE GROUP

		Factors Controlled											
		None			Intelligence			Intelligence			Chronological Age		
Group	Mean	D. F.	F_O	H	D. F.	F_O	H	D. F.	F_O	H	D. F.	F_O	H
Kindergarten													
Accepted	61.20	1	3.432	Acc.	1	.....	Acc.	1	2.752	Acc.	1	1.550	Acc.
Rejected	57.30	146			144			145			145		
Grade 1													
Accepted	64.42	1	11.961	Rej.	1	.....	Acc.	1	2.954	Acc.	1	8.600	Rej.
Rejected	56.89	144			142			143			143		

	.05	.01
$n_1 = 1$)	3.91	6.82
$n_2 = 144$)		

TABLE VIII

RELATIONSHIP BETWEEN A PUPIL'S ABILITY IN READING, ARITHMETIC, AND STUDY SKILLS AND THESE ABILITIES OF HIS BEST FRIEND

	Chosen as Friends			
	Best Achievers	Average Achievers	Poorest Achievers	Total
Best Achievers	137	92	73	302
Average Achievers	127	94	72	293
Poorest Achievers	104	117	80	301
Total	368	303	225	896

$\chi^2 = 8.7887$ $\chi^2.05 = 9.488$ $\chi^2.01 = 13.277$

ed the change in social acceptability, or whether these changes occurred simultaneously, remains a matter of speculation.

To summarize the results obtained through the analysis of covariance, it may be said that at the kindergarten level social acceptability does not seem to be related to academic success, (as measured by a reading readiness test given the following fall), whereas at all other levels such a relationship does exist. This indicates that social acceptability at the kindergarten level is based on factors other than those tested in a reading readiness test. What these factors are has not been determined in this study.

Investigation into the Possible Existance of "Clusters" of Pupils in the Classrooms

Chi-square analysis was used in searching for possible relationships between social acceptability and other school factors. It seemed plausible that in selecting one best friend, a child might choose one who was much like himself in reading ability, in intelligence, or in any of the other factors studied. Therefore, each upper grade class was divided into thirds in reading ability, in arithmetic score, in study skills, in intelligence, and in socio-economic status. In each division, the first choice of every individual in the class was located and placed in a chi-square cell to indicate whether he was in the same third as the individual who chose him on the particular factor under consideration, or whether he was in one of the other thirds. Since no significant results were found, the various parts of the data are not recorded here. However, to show the general trend, a composite chi-square table has been made to show the number of individuals in each cell according to the total number of choices in reading, arithmetic, or study skills (see Table VIII). Table VIII should be interpreted thus: of the 302 individuals who were in the upper third in reading, arithmetic, or study skills, 137 chose their one best friend from the upper third on the same achievement, 92 chose their best friend from the middle third on this achievement, and 73 chose from the group of poorest achievers. Since the relationship between acceptability and achievement has been established, it would be expected that more people would choose their best friend from among the best achievers. Therefore, the descending total scores in the table are in line with other results. However, if complete independence of choice were shown, the proportion of these best achievers to be chosen by each of the three groups would be the same. This does not appear to be the case. More of the best achievers were chosen by their own group than by either of the other two, and more of the poorest achievers were chosen by members of their own group than by the best or average achievers. The 117 poorest achievers who made their choices from the ranks of the average achievers indicate that there may be a trend toward choosing someone better, but not too much better, than oneself. However, as the chi-square value is only 8.7887, which is below the 5% level, the relationship is not statistically significant. Similar procedures were carried out for intelligence and for socio-economic status, but on no measure was there a significant relationship between the type of person choosing and the type of person he chose. Therefore it cannot be concluded that the classroom "clusters" are based on any of the five factors investigated.

Summary of the Analysis of the Results

When the problem of the relationship between social acceptability and achievement was set forth, several questions were posed in the expectation that the investigation could find an answer to them. The following summarizes the above results according to their contribution toward answering these questions.

First, do the most accepted children and the least accepted children differ in any of the achievements to be measured? The results of the analysis of variance and covariance have indicated that there is a very definite difference between these two groups in each factor measured at all levels except the kindergarten. In addition, the results indicate that if the factor of intelligence is controlled, the differences no longer exist.

Second, if there is a relationship between social acceptability and achievement, is it stronger at the end of the school year than after a summer vacation? In the upper grades a relationship was found to exist between social acceptability and both reading achievement and study skills before the summer vacation and also at the end of the vacation. Between arithmetic ability and social acceptability the relationship was not as definite after the vacation as before. At the lower grade level a change took place during the summer months or early part of the fall. Before the summer vacation, no relationship was found between acceptability and future reading readiness as tested in the fall; after the summer this relationship was a significant one. The cause of this change cannot be definitely determined by the present investigation.

Third, do children tend to join in clusters on the basis of any of the factors tested? The chi-square analysis presented indicated that no clusters of individuals may be found which are significantly different, in the achievements measured, from clusters which might arrange themselves by chance factors alone. Observation of the data indicate the possibility of a trend toward choos-

ing others who are a little, but not too much, better than oneself.

Fourth, will the relationship, if any exists, be stronger in the sixth grade than in kindergarten? Here the results of the analysis of variance and covariance show that no relationship between acceptability and achievement (as estimated by reading readiness test scores) exists at the kindergarten level, while a significant relationship between the social and academic factors exists at the sixth grade level. Therefore, the relationship appears stronger at the end of the elementary years than at the beginning.

Conclusions

The primary conclusion in this study, the one which refutes the null hypothesis, is that when we consider a classroom of boys and girls in either the early grades or the upper grades, it may be said that in general those who are succeeding in their school work will also be succeeding in their social relationships with their peers.

In addition, it would seem possible to draw an interpretation in regard to the way in which this relationship between social and academic success has come about. A tentative hypothesis that achievement, as a basic factor in acceptability, precedes rather than follows this acceptability is suggested by the change which takes place between the time the child is in kindergarten and the time he is in first grade and is beginning to experience some of the activities of which school success is made. In kindergarten, before academic success is evident, the future achiever is not chosen in social relationships any more frequently than the future non-achiever. Early in the first grade, when a different kind of achievement than occurred in kindergarten is becoming evident, those who are successful in this achievement are also the socially most accepted. If the acceptability were responsible for this achievement, those who had been popular in the kindergarten the preceding spring should be the ones to succeed in school in the fall. In reading readiness (our measure of estimated future achievement) this was not the case. Since there was a chance toward increased social acceptability for those who were succeeding in school, it would seem that this success might be a cause.

Further evidence corroborates this hypothesis. This second interpretation is based on the fact shown in the covariance analysis that the exclusion or inclusion of intelligence into the situation can make or destroy the relationship between social acceptability and achievement. If we believe in the relative constancy of the I. Q., we know that this is not because the acceptability is affecting the intelligence; therefore it may be that the intelligence and its resulting achievement are affecting the acceptability.

Implications

However, even if we were sure that the achievement was influencing the acceptability, there is no evidence from the present study to indicate the two factors continue to operate in the same direction throughout all of school. Even if the first step in the process of becoming rejected in school is a matter of non-achievement, it seems possible that a circular reaction might be set in motion so that once a child is unaccepted he becomes insecure and finds it more difficult than ever to succeed.

The analysis which shows that, by holding intelligence constant, these differences may be eliminated is, however, actually based on a hypothetical situation, for there is no possible way in which intelligence can be held constant in an actual classroom of boys and girls. Holding this factor constant in the analysis has given us the opportunity to ascribe to it much of the foundation for the fact that some children are accepted and others rejected, but it does not give us any help in solving the problem which faces so many of our boys and girls of how they may become socially more accepted.

Intelligence may be the foundation of the difference between the accepted and rejected child, but in the eyes of the children this difference is often manifested in the form of school achievement. Therefore, if a child's achievement may be improved, even if his basic intelligence may not, might this not make him more acceptable? For example, might not one of these achievements needed for acceptability be the ability to contribute to classroom discussions? The child who cannot play baseball is not chosen for the team. Will the child who stumbles in oral reading be chosen for dramatizations? If it is true that the child who achieves is more likely to be accepted, it is not so important for the teacher to work on the acceptability as such, but on the achievement which seems to be back of it in many instances. It is true that some children will never excel in the type of work they are given in many school situations, but there may be some way in which they can succeed. It is also true that there are many who, for one reason or another, are not working up to their ability and for whom greater success might be developed. And there are still others who may not know how to use the skills and abilities which they do have. This is a serious fact for teachers to consider. If by the way we gear the work we control the acceptability a child will have, provision for individual differences takes on even more significance. If all teachers adjusted the work so that all children were "succeeding" at their own level, would we get this same picture? This presents to the teacher a real challenge.

BIBLIOGRAPHY

1. Bonney, Merl E. "The Relative Stability of Social, Intellectual, and Academic Status in the Second, Third, and Fourth Grades, and the Interrelationships between these Various Forms of Growth," Journal of Educational Psychology, XXXIV (February 1943), pp. 88-102.

2. Bonney, Merl E. "A Sociometric Study of the Relationships of Some Factors to Mutual Friendships on the Elementary, Secondary, and College Levels," Sociometry, IX (Februrary 1946), pp. 21-47.

3. Criswell, Joan H. "Social Structure Revealed in a Sociometric Retest," Sociometry, II (October 1939), pp. 69-75.

4. Holzinger, Karl J. Statistical Methods for Students in Education (Boston: Ginn and Co., 1928), pp. 372.

5. Johnson, Palmer O. Statistical Methods in Research (New York: Prentice-Hall, Inc., 1949), pp. 377.

6. Kendall, Maurice G. The Advanced Theory of Statistics, Vol. I (London: Charles Griffin and Co., Ltd., 1947), pp. 457.

7. Loeb, Nora. The Educational and Psychological Significance of Social Acceptability and Its Appraisal in an Elementary School Setting, Unpublished Ph.D. thesis, University of Toronto, 1941.

8. McConnell, T. R. and Bond, G. L. Prediction of Stanford-Binet I.Q.'s from Group Tests at Earlier Grade Levels. Unpublished report, Bureau of Educational Research, University of Minnesota, Minneapolis, 1939.

9. McLendon, Ida R. An Investigation of Factors Associated with the Social Acceptance of Children in the Intermediate Grades of Hamilton, Ohio. Unpublished Ph.D. thesis, Ohio State University, 1947.

10. Mitchell, Mary A. The Relationship of Reading to the Social Acceptability of Sixth Grade Children, Contribution to Education, No. 953 (New York: Bureau of Publications, Teachers College, Columbia University, 1949), pp. 59.

11. Moreno, Jacob L. Who Shall Survive? (Washington, D. C.: Nervous and Mental Disease Publishing Co., 1934), pp. 437.

12. Raths, Louis. "Evidence Relating to the Validity of the Social Acceptance Test," Educational Research Bulletin, XXVI (September 1947), pp. 141-146.

13. Staker, Anna Marie. "Changes in Social Status of Elementary-School Pupils," Educational Research Bulletin, XXVII (September 1947), pp. 157-159.

14. Young, L. L. "Sociometric and Related Techniques for Appraising Social Status in an Elementary School," Sociometry, X (May 1947), pp. 168-177.

RELATIONS AMONG FACTORS OF RAW, DEVIATION, AND DOUBLE-CENTERED SCORE MATRICES

CHESTER W. HARRIS
University of Wisconsin

THE PURPOSE of this paper is to develop relations among factors of raw scores, deviation scores, and double-centered scores. The treatment is abstract and is merely an application of the algebra to the specialized matrices in which the interest of the factor analyst centers. Equivalence of matrices, either square or rectangular, and similarity of square matrices are general notions that underlie the discussion. In addition, use is made of a specialized case of equivalence of matrices that occurs if the symmetric matrices generated by these matrices are elements of the same multiplicative group. Finally, a "loose" relation among matrices that generate symmetric matrices of different ranks belonging to the same sub-ring, or sub-algebra, of the total matric ring is employed to describe some of the results. It will be assumed that only real score matrices are employed and consequently that the symmetric matrices they generate are not only real but also Gramian, that is, have no negative principal minors. This is merely an arbitrary choice of fields, made because scores ordinarily are taken to be real numbers.

The plan of the paper is first to describe a notation that permits writing deviation scores as the matric product of raw scores and an idempotent matrix. This notation should have a number of uses, a few of which are illustrated in this paper. Next, the resolution of conventional deviation scores into the product of factors and factor scores is summarized. This principle is, of course, well known; as it is summarized here, explicit use is made of the notion of groups of singular matrices for which a symmetric idempotent matrix is a unit for multiplication. With the method established, it is possible to write equations relating the factors of raw scores to the factors of deviation scores, and equations relating the factors of the two types of deviation scores. These results give a precise statement of Burt's reciprocity principle. Finally, double-centered matrices are considered. Apparently two types of double-centered matrices may be identified; the relation of factors of such matrices to the factors of raw or deviation scores is outlined.

It should be noted that an important restriction is made in this study. Throughout, it is assumed that the total variation exhibited in a set of data is to be analyzed in terms of common factors. This is a choice that the factor analyst may make. The results given here outline possibilities for relating solutions if he makes such a choice.

A Notation for Deviation-Score Matrices

A matrix, X, of n rows and N columns, with elements X_{ji} ($j = 1,2,3,\ldots,n$; $i = 1,2,3,\ldots,N$) may be identified conventionally with a matrix of measurements (i. e., raw scores) on n variables for N subjects. Define $x_{ji} = X_{ji} - M_j$ as the elements of the matrix of measurements in conventional deviation-score form; that is, with the mean of each variable equal to zero. An analogous deviation-score matrix has elements, say, $P_{ji} = X_{ji} - M_i$; that is, the mean of each subject is equal to zero. Either of these deviation-score matrices might be written as a difference of two matrices; it is more convenient, however, to write them as matric products. Thus:

$$XL = ||x_{ji}|| \qquad (1)$$

where the N-by-N matrix L is written for any N as follows:

$$\left\| \begin{array}{cccc} \frac{N-1}{N} & \frac{-1}{N} & \frac{-1}{N} & \frac{-1}{N} \\ \frac{-1}{N} & \frac{N-1}{N} & \frac{-1}{N} & \frac{-1}{N} \\ \frac{-1}{N} & \frac{-1}{N} & \frac{N-1}{N} & \frac{-1}{N} \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \frac{-1}{N} & \frac{-1}{N} & \frac{-1}{N} & \frac{N-1}{N} \end{array} \right\|$$

The matrix L has several interesting characteristics. It is completely determined by N, and it is evidently symmetric. Each of its arrays sum to zero; consequently, the rows of the product XL necessarily sum to zero, i.e., have means of zero. Further, L may be viewed as the product KK', where K is a set of (N - 1) orthogonal columns giving, with respect to a rectangular cartesian system of N axes, the direction cosines of an (N - 1) hyperplane in the N space. L's effect as a post-multiplier of X is to give the coordinates, with respect to the original N axes, of the orthogonal projections into the (N - 1) hyperplane of the n points defined in the N space by the rows of X.[1] In other words, if we view the column labels of X as designating a rectangular cartesian system, the effect of L is projective. However, if, as in a scatter-diagram for correlation purposes, we view the row labels of X as designating a rectangular cartesian system, the effect of L is to translate the axes. Finally, L is idempotent, i.e., $L = L^2$, its non-zero roots are all unity, and its rank is (N - 1), given by its trace. A familiar theorem then shows that the rank of XL cannot exceed (N - 1).

An analogous matrix, M, may be used to premultiply X to secure:

$$MX = \|p_{ji}\| . \qquad (2)$$

M is n-by-n and may be written for any n in the same manner as L is written for any N. The product MX necessarily sums to zero by columns, just as XL sums to zero by rows. M also is a symmetric idempotent, but of rank (n - 1), and the upper limit of the rank of MX clearly is (n - 1). The effect of M as a pre-multiplier of X is analogous to that of L as a post-multiplier. If we view the row labels of X as designating a rectangular cartesian system, the effect of M is projective; whereas if we view the column labels as designating a rectangular cartesian system, the effect of M is to translate the axes, i.e., to make the means of the subjects zero.

Analysis of Conventional Deviation Scores

It is well-known that a rectangular score matrix may be expressed as the product of two rectangular matrices, one identified as the factors of the variables and the other as the factor scores of the subjects.[2] Let us assume the main theorems of Guttman's paper and summarize the resolution of a matrix of deviation scores into principal-axis factors and factor scores. Note that since L is idempotent, XLX' equals XL^2X'. Let X and consequently XL be real; then the symmetric matrices XLX' and LX'XL are real and Gramian, i.e., all their non-zero latent roots are positive. If XL is of rank r, then both XLX' and LX'XL are of rank r and have exactly r non-zero latent roots. Flanders has shown that the elementary divisors of AB and BA corresponding to non-zero roots are the same.[3] Therefore, XLX' and LX'XL which are of the same rank have the same non-zero roots. In fact, if (y) is a characteristic vector of XLX' corresponding to a non-zero root, k, then (LX'y) is a characteristic vector of LX'XL corresponding to the same non-zero root, k.

Let G designate the matrix of r unit-length characteristic vectors of XLX' corresponding to its r non-zero latent roots. Let $r \leq n < N$. Then:

$$XLX'G = GD^2, \qquad (3)$$

where D^2 is written purely for notational convenience. D^2 is a diagonal matrix of order r and non-singular; its non-zero elements are the (positive) latent roots of XLX'. We shall use D to designate the diagonal matrix of positive square-roots of the non-zero elements of D^2. Now, since the columns of G are unit-length orthogonal columns,

$$G'G = I_r, \qquad (4)$$

and

$$GD(DG'GD)^{-1}DG' = GG' \qquad (5)$$

is a symmetric matrix that is a right and left

1. An exercise in Ferrar is pertinent. See: W. L. Ferrar, Algebra (Oxford, England: Oxford University Press, 1941), p. 108.

2. A number of persons have shown this, and in somewhat different ways. See, for example:

   Karl J. Holzinger, "Factoring Test Scores and Implications for the Method of Averages," Psychometrika, IX (September 1944), 155-167.

   Louis Guttman, "General Theory and Methods for Matric Factoring," Psychometrika, IX (March 1944), 1-16.

   Cyril Burt, "Correlations Between Persons," British Journal of Psychology, XXVIII (July 1937), 59-96.

3. Harley Flanders, "Elementary Divisors of AB and BA," Proceedings of the American Mathematical Society, II (December 1951), 871-873.

unit for XLX'; GG' also is a pre-multiplication unit for any factor matrix that reproduces XLX'.[4] Guttman's Theorem (f) guarantees the existence of an N-by-N orthogonal matrix, V, such that:

$$XLV = \|F\ O\| , \qquad (6)$$

where FF' = XLX'. Then GG', which is a pre-multiplication unit for F, necessarily is a pre-multiplication unit for XL, since

$$GG'XLV = XLV \qquad (7)$$

and V is non-singular.

Considering the matrix LX'XL and equation (3) gives:

$$LX'XL(LX'G) = LX'GD^2. \qquad (8)$$

Note that the r characteristic vectors (LX'G) are not of unit length, since from (3) and (4),

$$G'XLX'G = D^2. \qquad (9)$$

Normalize these characteristic vectors to secure:

$$LX'GD^{-1} = P, \qquad (10)$$

that is, r columns of normalized factor scores. It is immediately evident that LP = P, which implies that each column of P sums to zero and that P necessarily is singular. Then, from (3) and (10):

$$XLP = XLX'GD^{-1} = GD, \qquad (11)$$

or, since LP = P,

$$XP = GD. \qquad (12)$$

The singular matrix PP' is a symmetric idempotent that is a right and left unit for LX'XL and a pre-multiplication unit for LX', by a demonstration analogous to that for GG'. Also, P'P = I_r. Therefore, (11) may be written:

$$XL = GDP'. \qquad (13)$$

This is the resolution of XL into the product of principal-axis factors, GD, and normalized factor scores, P'.

There are three ways in which the resolution described in (13) might be accomplished. One is to operate, by an iteration procedure, on the matrix XL itself. This would be the factoring of the deviation scores directly.[5] A second is to form the matrix XLX' and solve for its characteristic vectors, G, and the accompanying non-zero roots. Then equation (10) yields P. A third approach is to form the matrix LX'XL and solve for its characteristic vectors, P. Then either (11) or (12) yields the factors, GD. Consider procedures two and three. Both of them are equally "correct" in that they arrive at the same results, even though they employ two different symmetric matrices for analysis. Clearly a "reciprocity" holds for the analysis of XLX' and of LX'XL, even though the one matrix, XLX', would commonly be judged to be "meaningful", and the other not. Note that XLX' is exactly a matrix of variances and covariances with each entry multiplied by N, and that it can be reduced by pre- and post-multiplication by a diagonal matrix to the familiar correlation matrix with units in the diagonal. Burt's reciprocity principle, therefore, is true for any matrix of data, say, Y, in that the principal-axis transformation of either YY' or Y'Y leads to the same resolution of Y. Burt, of course, specified in his proof the case where YY' and Y'Y both are meaningful.[6] Later we shall write equations that describe the cases Burt regarded as similar in principle but as exhibiting only an approximate reciprocity.

Equation (13) assumes that the total variation exhibited in the data is accounted for in terms of common factors. We might have chosen GDW as factors, where W is a non-singular transformation of order r, rather than GD, the principal-axis factors of XLX'. Note that substituting GDW for GD in (5) yields the same unit, GG', as before and that consequently the effect of selecting GDW rather than GD is merely to induce the inverse of this transformation on the right of P. These transformed matrices reproduce XL exactly:

$$XL = (GDW)(W^{-1}P'). \qquad (14)$$

However,

$$(GDW)(W'DG) \neq XLX' \qquad (15)$$

unless W is orthogonal. Instead:

$$(GDW)(W'W)^{-1}(W'DG') = XLX' \qquad (16)$$

4. If r = n, GG' = G'G = I_n, trivially. If r is less than n, GG' is idempotent and a unit as described. See: Chester W. Harris, "The Symmetrical Idempotent Matrix in Factor Analysis," Journal of Experimental Education, XIX (March 1951), 239-246.

5. See Guttman, op. cit., pp. 14-15, for such a suggestion. See also Holzinger, op.cit., for centroid and multiple-group factoring methods applied directly to a score matrix.

6. Burt, "Correlations Between Persons," loc. cit., p. 72.

is generally true. When W is not orthogonal, GDW should be identified with an oblique structure, rather than a pattern, in Holzinger's terms, providing that we recognize that the elements of GDW are the correlation coefficients associated with Holzinger's concept of structure only when the columns of W constitute direction cosines. Clearly, then, the resolution of a score matrix into the product of factors and factor scores is stated generally as a resolution into the product of a structure matrix and factor scores. Though it is convenient for the purpose of the proofs to specify a principal-axis resolution, the relationships developed below are generally true for any method, providing all the variation in the data is analyzed in terms of common factors.

Relation Between Factors of Raw and Deviation Scores

The relation between factors of raw scores and factors of conventional deviation scores is an interesting one. Resolve the matrix X into a product of principal-axis factors and factor scores, thus:

$$X = G_1 D_1 P_1'. \tag{17}$$

It can be shown that $G_1 G_1'$ and $P_1 P_1'$ are units of different orders, and that $G_1'G_1 = P_1'P_1 = I_r$. Substituting (17) in (12) gives:

$$GD = G_1 D_1 (P_1'P), \tag{18}$$

which is the desired relation.

If X and XL are of the same rank, r, as they surely are when n is less than N, then $(P_1'P)$ is a non-singular matrix of order r and we identify GD, the principal-axis factors of XLX', as an (oblique) structure for XX'. That it is oblique (but not necessarily a unit-length structure) is readily shown. With X and XL of the same rank, (18) implies that XLX' and XX' belong to the same multiplicative group of matrices with unit $G_1 G_1' = GG'$; this holds for r equal to or less than n. Then:

$$G(G'G_1) = G_1 \tag{19}$$

and

$$G_1(G_1'G) = G \tag{20}$$

with $(G_1'G)$ necessarily an orthogonal matrix. Premultiplying (18) by G_1' and re-arranging gives:

$$(P_1'P) = D_1^{-1}(G_1'G)D, \tag{21}$$

which cannot be an orthogonal matrix unless $D_1 = D = I_r$, which is the trivial case of $XX' = XLX'$. From this it can be inferred that with XX' and XLX' distinct but of the same rank, $P_1P_1' \neq PP'$, and there is no transformation operating solely on the right of P_1 that yields P. To see this, recall that PD constitutes principal-axis factors of X'X. Post-multiply (17) by L and equate it to (13), thus:

$$GDP' = G_1 D_1 P_1' L. \tag{22}$$

Then

$$PD = LP_1 D_1 (G_1'G), \tag{23}$$

that is, PD is an orthogonal rotation of LP_1D_1. It is then evident that:

$$P = LP_1 D_1 (G_1'G) D^{-1}. \tag{24}$$

Briefly, then, we have proved that with X and XL of the same rank the principal-axis factors of XX' may be transformed by post-multiplication by a non-singular matrix into the principal-axis factors of XLX', and that the principal-axis factors of LX'XL are an orthogonal rotation of the matrix LP_1D_1, where P_1D_1 designates the principal-axis factors of X'X. The first statement is obviously true for any type of factors providing they are non-singular transformations of principal-axis factors. The second is true for any factors that are orthogonal rotations of the principal-axis factors; it must be modified if non-orthogonal factors are meant.

It may occur that the rank of XL is less than the rank of X. If so, we have a "loose" relation between the factor matrices G_1D_1 and GD. It will be true that G_1G_1' is a unit for XX', XLX', and GG' which is a unit for XLX' is not a unit for XX'. The matrices XX' and XLX' are not members of the same multiplicative group, since they are no longer of the same rank, but they are both members of the sub-ring of matrices of order n that is defined by pre- and post-multiplication of every element of the total matric ring by G_1G_1'. The results, of course, are trivial if G_1 is non-singular since this implies the total matric ring is taken as a sub-ring of itself. However, the relations given in equations (18), (23) and (24) hold for XL of lower rank than X, with the matrices in parentheses singular.

Relation Between the Factors of X and MX

Recall that MX is an alternate deviation-score matrix, that is, one in which the means of the subjects have been made zero. Write:

$$MX = G_2 D_2 P_2'. \tag{25}$$

Then, using (17), we may equate:

$$MG_1 D_1 P_1' = G_2 D_2 P_2'. \tag{26}$$

Two consequences of this are:

$$MG_1D_1 = G_2D_2(P_2'P_1), \qquad (27)$$

and, since $MG_2 = G_2$,

$$P_1D_1(G_1'G_2) = P_2D_2. \qquad (28)$$

When X and MX are of the same rank, as they surely are when N is less than n, P_1P_1' equals P_2P_2', but G_1G_1' is not equal to G_2G_2'; the matrix $(P_2'P_1)$ is orthogonal; and $(G_1'G_2)$ is non-singular. The results are the counterparts of those for X and XL.

Relations Between Factors of MX and XL

The case of MX and XL is the case of the same set of raw scores put into the two possible deviation-score forms. Then X'MX gives interrelationships of the subjects expressed as a scalar, n, times the matrix of variances and covariances of persons; and XLX' gives interrelationships of the variables expressed as a scalar, N, times the matrix of variances and covariances of the variables. Equations (13) and (25) give the resolution of XL and MX into principal-axis factors and factor scores. Then we may equate:

$$MGDP' = G_1D_2P_2'L, \qquad (29)$$

which, recalling that LP equals P and MG_2 equals G_2, gives:

$$MGD = G_2D_2(P_2'P) \qquad (30)$$

and

$$PD(G'G_2) = LP_2D_2. \qquad (31)$$

The matrices in parentheses in (30) and (31) are related in this fashion:

$$D_2^{-1}(G_2'G)D = (P_2'P). \qquad (32)$$

They may, of course, be singular; the equations hold, however, regardless of the rank of these matrices.

Equations (30) and (31) are important since they state precisely the relation to be found between the results of independent analyses of the two "meaningful" matrices X'MX and XLX'. The relation is one that Burt judged to be only "approximate", unless the data were double-centered.[7] Actually the relation is precise; the complications are introduced by the matrices L and M, which are singular. However, the presence of L and M in the equations makes clear that the relation is one between factors—or between factor scores—that have been made bipolar, since this is exactly the effect of M on GD and L on P_2D_2. It also is evident that given only G_2D_2, one could not reproduce GD and similarly given only PD, one could not reproduce P_2D_2. However, given, say, GD and G_2D_2 (or any non-singular transformations of them) it will always be possible to solve for a transformation that relates MGD and G_2D_2. This is true because M is known when n is known, and the two matrices MGD and G_2D_2 generate symmetric matrices belonging either to the same multiplicative group (when they are of the same rank) or to the same sub-ring (when they are of different ranks). The rationale and equations for the solution of such problems have been presented elsewhere.[8] An analogous statement may be made concerning the problem of relating a given PD and P_2D_2.

It also is possible to write the relation given in (30) and (31) in terms of factors and factor scores secured from analyzing correlations. Write:

$$S_aXL = G_aD_aP_a' \qquad (33)$$

and

$$MXS_b = G_bD_bP_b' \qquad (34)$$

where each S is a diagonal matrix that makes the variance of the appropriate arrays unity. Then $S_aXLX'S_a$ is the complete correlation matrix describing the interrelationships of the variables, and $S_bX'MXS_b$ is the complete correlation matrix describing the interrelationships of the subjects. Each S is non-singular, and so we may write:

$$XL = S_a^{-1}G_aD_aP_a' \qquad (35)$$

and

$$MX = G_bD_bP_b'S_b^{-1}, \qquad (36)$$

and then equate:

$$MS_aG_aD_aP_a' = G_bD_bP_b'S_b^{-1}L, \qquad (37)$$

to give:

$$MS_a^{-1}G_aD_a = G_bD_b(P_b'S_b^{-1}P_a) \qquad (38)$$

and

$$P_aD_a(G_a'S_a^{-1}G_b) = LS_b^{-1}P_bD_b, \qquad (39)$$

which are analogous to (30) and (31).

Since the Burt-Stephenson controversy is familiar to many readers, it may be pertinent to com-

7. Cyril Burt, Factors of the Mind (New York: The Macmillan Co., 1941). See especially his discussion in Chapter VI and in Chapters XVI, XVII, and XVIII of Part III.

8. Harris, op. cit.

ment on these results in that context.[9] Providing one is willing to analyze in terms of common factors all the variation in a given set of data, it obviously makes no difference whether he proceeds by multiplying together rows to secure a symmetric matrix for analysis or by multiplying together columns to secure such a matrix. This is true even though one of the symmetric matrices is not thought of as a "meaningful" one. It seems likely that Stephenson would not be willing to analyze all the variation in terms of common factors; if so, he probably would judge this generalization to be irrelevant. However, the generalization does raise a question about the two types of data that Stephenson postulates—one appropriate for r-technique and the other appropriate for Q-technique. The analysis of all the variation in terms of common factors makes such a distinction meaningless, since it does not require that the two possible symmetric matrices both be "meaningful." In fact, it was shown that the raw scores themselves, which generate two "meaningless" matrices, might be analyzed and the results related to the analysis of deviation scores. This could easily be extended to show the relationship of the results of the analysis of raw scores to the results of the analysis of correlation matrices. Burt's anticipation that a reciprocity would hold generally, as well as for double-centered matrices, has been verified and the equations written as (30) and (31), (38) and (39). The results given here clearly support Burt's position.

Double-Centered Matrices

The notation used here suggests immediately that for any X, MXL is double-centered, i.e., it sums to zero both by rows and by columns. Since the multiplication of matrices is associative, it makes no difference whether one first forms (MX) and then centers by rows, or first forms (XL) and then centers by columns. It also is evident that a resolution of MXL might be written in terms of the resolution of X, the resolution of XL, the resolution of MX, or be written de novo for the double-centered matrix. Thus the relations of factors (or factor scores) of X, XL, or MX to those of MXL may readily be written if they are desired.

Two types of double-centered matrices are worth noting. Consider a set of data, X, and a method by which we operate on the rows of X to achieve equal, but non-zero, sums for the rows. Dividing each row by the sum of that row achieves this. Let S_r be the diagonal matrix that performs this division. Then it follows that MS_rX is double-centered, that is,

$$MS_rX = MS_rXL. \qquad (40)$$

For example, Howells reports the use of a matrix of this type.[10] He found the mean for each measurement and then took each element as a percentage of the mean for that measurement. Thus the mean of each row, in this transformation, became 100. Then he correlated the subjects and used a communality principle to factor these correlations: Thus he used a matrix of the type of (40), post-multiplying it by a diagonal to give unit variances for the subjects. Howells raises the question of the relationship of these results to those of a conventional analysis of measurements, and he points out that an attempt to establish a relationship did not give satisfactory results.[11] The development given here outlines one way in which a relationship could be established.

A second type of double-centered matrix arises when we post-multiply X by a diagonal, S_c, whose effect is to make the sum of the columns a non-zero constant. Then:

$$XS_cL = MXS_cL. \qquad (41)$$

For example, a paired-comparison instrument yields for each subject a set of scores that sum to a constant; a set of such data for N subjects would then constitute a matrix (XS_c), in which X actually is unknown. Putting this matrix into conventional deviation-score form, that is, post-multiplying by L, necessarily double-centers the data. Guilford's prohibition against factoring ipsative scores and his recommendation that Q-technique be used instead[12] apparently is a preference for analyzing the matrix MXS_c, which is not double-centered, rather than the matrix XS_cL, which is. The methods of relating solutions used here suggest that equations may be written showing that the factors derived from analyzing these two distinct matrices actually are related in a manner analogous to the relation of factors of raw and conventional deviation scores.

---

9. Cyril Burt and William Stephenson, "Alternative Views on Correlations Between Persons," Psychometrika, IV (December 1939), 269-282.

10. W. W. Howells, "A Factorial Study of Constitutional Type," American Journal of Physical Anthropology, X (March 1952), 91-118.

11. Ibid., p. 114.

12. J. P. Guilford, "When Not to Factor Analyse," Psychological Bulletin, XLIX (January 1952), p.31.

FACTORS RELATED TO THE EXTENT OF MORTALITY AMONG HOME ECONOMICS STUDENTS IN CERTAIN COLLEGES OF MINNESOTA, WISCONSIN AND IOWA DURING 1943-50

HELEN Y. NELSON
Augsburg College
Minneapolis, Minnesota

COLLEGE FACULTIES need to consider the implications of the fact that a very large percentage of students who enter as freshmen drop out before they graduate. The writer recently completed an investigation of the academic mortality among home economics students in 14 colleges and universities in Minnesota, Wisconsin, and Iowa. These represented all of the colleges in the three states which offered a degree in home economics and which had records of their drop-out students. Involved in the study were those who entered as freshmen from the fall of 1943 through the spring of 1948, and who dropped out of home economics before the spring term of 1950.

The author visited personally each of the institutions and obtained data from official records regarding many items; those relating to the college, those relating to the student body, and those relating to the drop-outs from the home economics curriculum. She learned about the type of support, the length of term, the cost of tuition and fees, and the honor-point equivalents for the different letter marks. She discovered the size of the student body and the home economics enrollment in terms of majors and non-majors for each year, and the number who graduated. She discovered the age at entrance of the drop-outs, how many credits they had earned and the marks they had received, and how long they had remained in college. Each college supplied the names of all drop-outs for the period studied and their addresses.

A questionnaire was sent to each of the 2263 voluntary drop-outs,* but 197 letters were returned because they could not be delivered. Sixty-eight percent of the group who presumably received the questionnaire responded. Their replies furnished information regarding their reasons for enrolling in home economics, guidance before and during college; their extra-curricular activities, church attendance and work experiences; home community and living conditions at college; their reactions to college courses in home economics and in other required subjects; specific reasons for leaving home economics and present marital status.

The responding group was apparently an unselected sample of the total population from whom information was solicited, because no differences in means or variances for four factors (age at entrance, credits earned, honor-point ratios, and length of stay in college) were large enough to be of any practical significance.

The findings were punched on Hollerith cards and the cases were classified into various subgroups: those from large institutions and from smaller colleges; those who had transferred to another curriculum or another college and those who had dropped out of college; and those who had remained in home economics for different lengths of time.

Analysis of the data revealed the facts discussed in the following section. Some of the elimination took place within a few days or weeks after entrance, but the greatest losses occurred at the end of the first and second year. Only 13 percent dropped out after the beginning of the junior year. The scholarship average for the voluntary drop-outs was 2.14 (with A equal to 4 honor points per credit). Most girls had entered at 18; the median length of stay was five terms, during which time they had earned an average of 58 credits. College records supplied little information as to reasons for leaving—for 90 percent the reasons were unknown.

Extent of Student Mortality in Home Economics

The extent of student mortality in home economics was determined by calculating the ratio of students withdrawing to the total group of freshman entrants to that curriculum. About half of the freshmen entering home economics in the col-

* The study involved only those who had left in good academic standing. Eleven percent had been eliminated because of scholastic deficiencies.

leges studied during the years 1943-45 dropped out before graduation. Mortality was greater in the large institutions (53 percent) than in the small colleges (32 percent). The percentage of students who dropped out of home economics in these colleges ranged from 19 to 55 percent.

In the majority of the comparisons made, there were no significant differences between the drop-outs from the large and from the small colleges. Marriage was the chief reason given for withdrawal. More than half gave this reason. About a sixth left for financial reasons and a similar proportion for lack of interest or scholastic difficulties. A few listed illness as a cause for withdrawal. Most of those who transferred to some other curriculum said that home economics had not interested them or they objected to the large number or difficulty of the prerequisites.

Many of those who transferred out of home economics went into fields which required less than a four-year program. A tenth of those from the large colleges (which were state-supported institutions) and a fifth of those from the small colleges said they transferred to one where the costs were lower.

Reasons for Enrolling in Home Economics

About a third said they had taken home economics because they thought it would be practical; about a third gave as their reason preparation for professional jobs in home economics; a sixth gave preparation for homemaking, and the others said that they had had no real interest in the field but had been persuaded to enroll by their parents or because they could not get into the field of their first choice.

Unless they had studied home economics in the senior high school, few listed high school instruction as a factor causing them to enroll for that course in college. High school counselors and other teachers had influenced few of them to take home economics.

Guidance

Before they came to college their parents had been the chief source of guidance—personal, educational, and vocational. Some felt that teachers had been the most helpful in their solving of personal problems; others listed friends who were apparently helpful with respect to educational problems. Few reported help from counselors on any type of problem, perhaps because many of the schools did not have specialized counselors.

During the time they were in college, they apparently received more help from counselors than they had in high school; but fewer reported help from any source in college than in high school. The picture was similar in the case of those who remained but a short time and those who remained longer.

Participation in Activities Outside the Classroom

Most of the respondents from both large and small colleges had participated in some social activities; the longer they were in college the more likely they were to report such participation. Informal social contacts were most frequently listed as having given them satisfaction; next came activities in church groups, athletics, and music. The modal number of hours spent in extra-curricular activities was less than ten hours a week, but about a tenth of the students reported that they usually devoted twenty hours a week or more to such activities.

Respondents (from both large and small colleges) who remained in college less than a year were likely to have participated in out-of-class activities less in college than in high school. Those who stayed longer than a year were significantly more likely to have participated as much as in high school or to have increased the amount of their participation in college.

Home Communities

Over a third of the respondents from large colleges and nearly half of those from small colleges came from towns of less than 5000 population. Approximately a third of them came from towns with populations of 5000 to 50,000. More of the respondents who left large colleges came from cities of over 50,000.

Living Arrangements During College

More than two-thirds of the respondents lived in dormitories while attending college; somewhat less than a fourth lived with parents or relatives; about a tenth in rooming houses. Those who lived in sorority houses ranged from three percent of the girls who remained less than one year to 22 percent of those who stayed more than two years.

About three-fourths of the drop-out students had attended a college outside their home community but this proportion varied in the different colleges. The distance of the student's home from the college did not appear to be an important factor in determining the length of her stay in college.

Religious Affiliation

Most of the respondents had maintained the same religious affiliation as they had at home. The relatively few who had changed after coming to college were usually students who had remained

a year or longer. Most students who stayed in college more than a year reported that they had been church attendants.

Reactions to College Courses

More than half of the respondents from large colleges regarded the prerequisite requirements (especially those in science) as unsatisfactory; significantly fewer from the small colleges expressed this reaction. More respondents criticized the quantity than the difficulty of the courses.

About half of the respondents from large colleges said that home economics courses had been taught in too theoretical a manner. Significantly fewer from the small colleges expressed this reaction.

Significantly more of the drop-outs from the small colleges (56 percent) cited an undesirable amount of repetition between high school and college courses; only about a third of the respondents from the large colleges who had had instruction in high school made this criticism.

Nearly half of the respondents who had attended small colleges believed that the practical courses had come too late in their curriculum; and nearly two-thirds of those from the large institutions expressed this reaction. The replies of both married and single respondents were similar on this point.

Marital Status

Three-fourths of the respondents were married at the time of this inquiry. A few had married before starting college; some married while attending school, and one in ten married immediately after leaving school. The majority of those who married had done so within a year after leaving college.

Employment During and After College

Less than half of the respondents from either large or small colleges had earned any of their expenses through work done during the academic year, although a few had earned more than third of their expenses. More than half reported earning during the summer.

Two-thirds of the respondents who were married had worked for some time at a job outside the home after marriage, although 80 percent of them reported no occupation other than homemaking at the time they received the questionnaire. About a fourth of them had held a job for a few months after marriage; a fifth had worked from one to two years. Some of the women had worked two years or more. Very few had held jobs as long as three years. Only a few had held jobs which utilized their home economics training, whether they had stayed in home economics two or more years or only a short while.

Reactions Toward Their College Experience

While more of these young women who had spent a year or more in college expressed favorable reactions toward college, those who were critical were much more vocal, going into a great deal of detail to explain what they did not like. However, even though many respondents offered criticisms of their college home economics courses, a large number of them stated they were sorry they had not stayed longer; others remarked that they wished they could return for more study in home economics.

Implications of the Investigation

A certain amount of elimination must be expected from any entering class, but a loss of half of the students entering home economics as freshmen should certainly make faculties pause to consider its implications. The fact that the great majority of these students who left home economics before graduation were apparently competent enough to have finished their courses disproves the belief held by many people that most of the drop-outs are not of college caliber.

Since marriage was the reason most frequently cited by respondents for dropping out of college it would be well to institute research to discover what is needed for a well-rounded preparation for home and family living for the young homemaker in present-day society, and to appraise college homemaking programs in the light of a recognition of these needs. A reorganization in content of courses, the sequence of offerings, and the types of experiences provided might be important outcomes of such appraisal.

Since the greatest losses occurred at the end of the first and second years, it would be well for home economics departments to examine the first two years of their programs with particular care to determine the appropriateness of the work for students who will not complete a four-year curriculum.

Since a third of the respondents who entered college expecting to prepare for a career in some area of home economics did not carry out their plans, the basic program for all majors should be appraised in the light of education for home and family living. It may be that a series of courses set up to prepare students for a profession (even though it is a home economics profession) does not furnish optimum preparation for home and family living.

Certain factors in home economics curricula appeared to be related to the students' loss of interest and to withdrawal before graduation. One

of these factors was the duplication of subject matter and experience from one learning level to another. It should be possible to use pretesting to determine what high school, home, and other agencies have contributed to the student's understanding and skill in the various areas of home economics, so that unnecessary repetition and duplication of effort may be avoided. Time thus saved by the able student exempted on the basis of tests from elementary courses in home economics could be used to enrich her curriculum in other areas of general education, or to permit her to include more advanced work in her specialized field before she completes requirements for a degree.

Another factor which appeared to have been associated with withdrawal from home economics before graduation was the postponement of practical home economics courses until the later years of the curriculum because of heavy prerequisite requirements in the biological and physical sciences. Experimentation with teaching some courses without prerequisites might permit the reorganization of department offerings so that the practical courses bearing on important personal, home, and family problems would be available early in the students' college careers. Professional sequences could be built upon these courses.

A third factor which seemed to be related to loss of interest and withdrawal was the teaching of home economics courses with emphasis upon the theoretical rather than the practical aspects. The need for experimentation in methods of teaching various courses with particular attention to evaluation of the learning, seems to be clearly indicated.

Lack of effective guidance and counseling before and during college attendance seemed to be associated with withdrawal. Careful student guidance is needed in high school as well as early in the college program. The home economics teacher should make use of her distinctive opportunities for helping her students through counseling.

None of the following environmental and personal factors seemed to be associated with withdrawal from home economics: the place of residence while at college, the distance of the student's home from college, church affiliation, participation in extra-curricular activities, part-time employment while attending college.

The size of the institution seemed to bear no relationship to many of the factors studied. With respect to some, however, differences emerged, suggesting strengths and weaknesses of both types of programs. Student mortality in home economics was greater in large institutions. More respondents who had left large colleges criticized the number and difficulty of prerequisite requirements; more of them felt that the practical home economics courses were not offered soon enough; and more of them felt that their home economics courses had been too theoretical. However, more of the respondents from the small than from the large college considered that their elementary college courses had been a repetition of materials they had studied in high school economics.

This study has revealed many phases of the problem of the withdrawal of home economics students which merit further research. Serious consideration should be given to a study of what is needed as a well-rounded preparation for home and family living. Then such experimental studies as the following might well be carried on: using pretests as a basis for locating able students who could be exempted from elementary courses in home economics; teaching beginning home economics courses without prerequisites; developing shorter chemistry courses for majors other than in dietetics and food technology.

It is, of course, not assumed that the findings of this investigation of a group of drop-out students from colleges in three states would apply to all colleges that offer home economics courses leading to a degree. But it is believed that similar studies by home economics departments of their own students would be tremendously valuable in appraising educational programs of their institutions and in improving them.

ERRATA

The last line of column 2 on page 269 of the Caffrey-Wheeler article published in the March 1953 Journal of Experimental Education, should read

$$\text{either } (A + B) \text{ or } (C + D) \neq \frac{N}{2}$$

That is, the formula (3) cannot be used unless the sums indicated are not equal to N/2.

The so-called Yates correction for use when the entry in any cell is equal to or less than 5 (or 10, as some texts specify) can be embodied in our formula (3). This could be concisely stated as follows:

> "When any cell entry is equal to or less than a specified minimum (say, 5), a corrected value may be computed by decreasing the absolute difference $|B - D|$ by 1, as follows:
>
> (3c) $$\chi^2 = \frac{N\,(|B - D| - 1)^2}{(B + D)(N - (B + D))}$$ "

Specifications for Manuscripts

. . . for the . . .

JOURNAL OF EDUCATIONAL RESEARCH

. . . and the . . .

JOURNAL OF EXPERIMENTAL EDUCATION

1. All manuscripts must be typewritten, double spaced, and on one side of the sheet only. Mimeographed and ditto sheets are acceptable only when very clearly printed.
2. All unusual symbols or formulae must be very clearly typed or hand printed in black ink. To avoid costly printers' composition charges it may be necessary for us to make cuts of difficult matter, or to print your material by the photo-offset lithography method. The latter means photographing your actual copy. It is expensive to have material redrawn by our own artists, and retracing or duplicating increases the hazards of error. See that your copy is correct and complete as you wish to have it reproduced. The men who work on your manuscripts are not trained to understand the working symbols and language of your technical field.
3. The same restrictions and requirements as in Paragraph 2 apply to all drawings, graphs or other illustrated materials,—they must be neatly done, in black ink, on bond paper or tracing cloth suitable for reproduction. Remember our magazines are printed in black ink only. Color graphs should be changed by the author to provide different kinds of shading for the different areas. For example: diagonal lines for red, vertical lines for blue, etc. Provide a key.
4. All tables, graphs, etc., on sheets by themselves must be properly labeled and identified in relation to the written copy of the manuscript.
5. Footnotes must be complete as to author, title, place of publication, publisher, date and pages. They must be numbered consecutively throughout the article.
6. Bibliographical notes must be complete and arranged alphabetically.

The cooperation of all prospective authors in following these rules is earnestly required. It is difficult to produce technical journals accurately, neatly, and on time under the best conditions. Promptness in printing, economy, and accuracy will be promoted by carefully prepared manuscripts.

A New

Educational Statistics Primer

Written by students for students

- Statistics self-taught for the non-mathematical student
- Who desires a more intelligent reading of technical papers in education, and
- Who desires to make easy statistical calculations with speed and accuracy

This pocket edition of statistics explains and illustrates calculation procedures for:

Measures of central position

Measures of variability

Zero order correlation and simple regression

Errors of measurement and sampling

Multiple correlation and regressions

Ready now . . . . . Price $1.25

DEMBAR PUBLICATIONS, Inc.

Madison 3, Wisconsin